DEPART OF THE INTERIOR
U.S. FISH WILDLIFE SERVICE

3-201
(1/97)

FEDERAL FISH AND WILDLIFE PERMIT

1. PERMITTEE

LA CANTERA DEVELOPMENT COMPANY
9830 COLONNADE STREET
SIXTH FLOOR
SAN ANTONIO, TX 78230

2. AUTHORITY-STATUTES
16 USC 1539(A)

REGULATIONS *(Attached)*
50 CFR 17.22
50 CFR 13

3. NUMBER
TE044512-1 AMENDMENT

4. RENEWABLE
[X] YES
[ ] NO

5. MAY COPY
[X] YES
[ ] NO

6. EFFECTIVE
10/31/2001

7. EXPIRES
10/31/2031

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If #1 is a business)*
GLEN E. MITTS
VICE PRESIDENT

9. TYPE OF PERMIT
ENDANGERED SPECIES

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
On the approximately 1,000-acre La Cantera Property, San Antonio, Bexar County, Texas.

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

[X] ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS
On October 1 of each year the permit is in effect.

ISSUED BY	TITLE	DATE
Nancy M. Kaufman	REGIONAL DIRECTOR	10/22/2001

D. General conditions set out in subpart D of 50 CFR 13, and specific conditions contained in Federal Regulations cited in Block #2 above, are hereby made a part of this permit. All activities authorized herein must be carried out in accord with and for the purposes described in the application submitted. Continued validity, or renewal, of this permit is subject to complete and timely compliance with all applicable conditions, including the filing of all required information and reports, subject to and in accordance with the terms and conditions of the HCP.

E. The Permittee and Participants under the Implementing Agreement are authorized to "Take" (kill, harm, harass) the Madla Cave meshweaver (*Cicurina madla*), *Rhadine exilis* and *Rhadine infernalis* (no common names), to the extent described and specified in the EA/HCP, incidental to activities during the construction, operation, and management of new developments as described in the Permittee's application and supporting documents, and as conditioned herein.

F. The validity of this permit is also conditioned upon strict observance of all applicable foreign, state, local or other Federal law.

G. Valid for use by Permittee named above and "Participants" pursuant to the Agreement of Inclusion process described in the Permit Implementing Agreement by and between the Service and the Permittee (the "Implementing Agreement").

H. Acceptance of this permit serves as evidence that the Permittee, (and their designated agents), understands and agrees to abide by the terms of this permit and all sections of title 50 Code of Federal Regulations, Part 13 and 17, pertinent to issued permits. Section 11 of the Endangered Species Act of 1973, as amended, provides for civil and criminal penalties for failure to comply with permit conditions.

I. The Permittee, Participants, and Management, as applicable, shall in a timely fashion and completely comply with and perform their respective obligations under the HCP and the Implementing Agreement, such obligations being incorporated into the terms of this Permit by this reference.

J. Funding for the genetics study will be provided by the Permittee within 90 days of permit issuance.

K. Transfer of a preserve(s) to a third party Service approved, Management entity shall in no way impair the ability to fully implement management and monitoring of the transferred or any other preserve(s) as described in the HCP. The Management obligations will be made binding through covenants that run with the Preserve or Preserves in question.

L. The Permittee or Management, as applicable, shall submit an Annual Report of preserves management and monitoring to the Service on October 1 of each year the permit is in effect. This report will include, but is not limited to, implementation of mitigation measures, inspection forms, results of regular inspections, management actions taken, any damage occurring and corrective actions taken, species and cave monitoring results (including copies of monitoring forms), and a report on the status of each listed species within the preserves.

M. Written annual reports of the year's activities (including, but not limited to, the status of preserve acquisition and outreach and research projects), will be submitted by October 1 of each year to the U.S. Fish and Wildlife Service Office, 10711 Burnet, Suite 200, Austin, Texas 78758; and to the U.S. Fish and Wildlife Service Office, 500 Gold Ave, SW, Room 4012, Albuquerque, New Mexico 87102.

N. Upon written notification to the Permittee or Management, the Service will be allowed access to the karst preserves to inspect the condition of the caves and preserves to ensure that the HCP is being implemented according to its terms for the benefit of the listed species. In the event the Service finds that the HCP is not being implemented according to its terms, the Service has the option of terminating and revoking the permit in accordance with applicable regulations under 13.28 (1999, as amended).

O. The "Covered Species" listed in Section 6.7.1 of the HCP are considered adequately addressed under the HCP and are, therefore, covered by no surprises rule.

P. Upon locating a dead, injured, or sick listed karst invertebrate, or any other endangered or threatened species, Permittee is required to contact the Service's Law Enforcement Office, San Antonio, Texas, (210) 681-8419, for care and disposition instructions. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state for analysis of cause of death. In conjunction with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, the Permittee and its contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

Q. Conditions of this permit shall be binding on and for the benefit of the Permittee and its respective successors and assigns. If the permit requires an amendment because of change of ownership, the Service will process that amendment without the requirement of the Permittee preparing any new documents or providing any mitigation over and above that required in the original permit. The construction activities proposed or in progress under an original permit may not be interrupted provided the required conditions of an issued permit are being followed.

R. If during the tenure of this permit the project design and/or the extent of the habitat impact described in the HCP is altered, such that there may be an increase in the anticipated take of the karst invertebrates, the Permittee is required to contact the Service and obtain authorization and/or amendment of the permit before commencing any construction or other activities that might result in take beyond that described in the EA/HCP.

Amendment #1

S. The Permittee name has been corrected from "La Cantera Development Company, LTD", to "La Cantera Development Company."

-End Permit-

Environmental Assessment/Habitat Conservation Plan for Issuance of an Endangered Species Act Section 10(a)(1)(B) Permit for the Incidental Take of Two Troglobitic Ground Beetles (*Rhadine exilis* and *Rhadine infernalis*) and Madla Cave Meshweaver (*Cicurina madla*) During the Construction and Operation of Commercial Development on the Approximately 1,000-Acre La Cantera Property, San Antonio, Bexar County, Texas.

U.S. Fish and Wildlife Service
10711 Burnet Road, Suite 200
Austin, Texas 78758

October 11, 2001

TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

COVER SHEET

Title for Preferred Action: Environmental assessment for issuance of an Endangered Species Act section 10(a)(1)(B) permit for the incidental take of two troglobitic ground beetles (*Rhadine exilis* and *Rhadine infernalis*) and Madla Cave meshweaver (*Cicurina madla*) during the construction and operation of commercial development on the approximately 1,000-acre La Cantera Property, San Antonio, Bexar County, Texas.

Unit of the U.S. Fish and Wildlife Service Proposing the Action: Regional Director, Region 2, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Legal Mandate for Preferred Action: Endangered Species Act of 1973, as amended, section 10(a)(1)(B), as implemented by 50 CFR 17.22.

Document Author: U.S. Fish and Wildlife Service - Austin Office, 10711 Burnet Road, Suite 200, Austin, Texas 78758.

1.0 INTRODUCTION

La Cantera Development Company (Landowner; Applicant; Permittee), and its affiliates for which it acts as the managing general partner, owns approximately 1,000 acres of commercial and residential development property generally bounded by I-10 to the east, Loop 1604 to the south, Babcock Road to the west, and Camp Bullis Road to the north in the City of San Antonio, Bexar County, Texas (Figure 1). Within this 1,000 acres, existing development includes a resort and golf club and certain infrastructure. For the purposes of this Environmental Assessment/Habitat Conservation Plan (EA/HCP), the "Property" consists of all areas depicted in brown, green, and blue on Figure 2. The currently developed portions of the property (in black) and the areas that are not part of the Property (in red) are not covered in the EA/HCP and for the purposes of the EA/HCP are not considered to be part of the Property.

One federally listed endangered species, *Rhadine exilis*, a troglobitic ground beetle, has been documented as occurring within two caves on the Property. A troglobitic spider of the genus *Cicurina* also occurs in these two caves, as well as in a third cave on the Property. Based on the best available scientific information, this spider is most likely a federally listed endangered species, Madla Cave meshweaver (*Cicurina madla*). However, it is also possible that this species of *Cicurina* is not a listed species, but one that may be a previously undescribed species of that same genus (J. Cokendolpher, Arachnologist, pers. comm. 2000). Although an adult specimen of this spider sufficient for positive identification has not been collected from the La Cantera caves, based on the known distribution of Bexar County spiders of the genus *Cicurina,* and other factors (see Section 3.3), this spider is assumed, for purposes of this document, to be the federally listed *Cicurina madla. Rhadine infernalis* has been documented within the University of Texas at San Antonio (UTSA) karst region (Veni and Associates, 1994) (Figure 3) although it is not known from the Property. However, if permitted, the Applicant will receive coverage for this species since it has been adequately mitigated for within the proposed preserves.

This EA/HCP addresses the Property and describes the impacts that would likely result to *Rhadine exilis* and *Cicurina madla* from new development within the Property. The document evaluates the Preferred Alternative, three alternative actions and gives details on what steps the Applicant will take to minimize and mitigate such impacts, and the funding that will be made available to implement those steps.

2.0 PURPOSE AND NEED FOR ACTION

The purpose of this EA/HCP is to evaluate and provide the basis for issuance of an Endangered Species Act (Act) section 10(a)(1)(B) incidental take permit in connection with the development and operation of the Property. The proposed development of the Property necessitates an evaluation of the environmental impacts for issuance of a section 10(a)(1)(B) permit for the Preferred Alternative, two development alternatives, and the no action alternative. The permit would authorize the potential incidental take of the aforementioned affected species associated with new development of the Property. This EA/HCP will establish the conditions under which the Applicant will meet the requirements for issuance of a Section 10(a)(1)(B) permit under the Act. The need for the permit is so that otherwise lawful development may proceed.

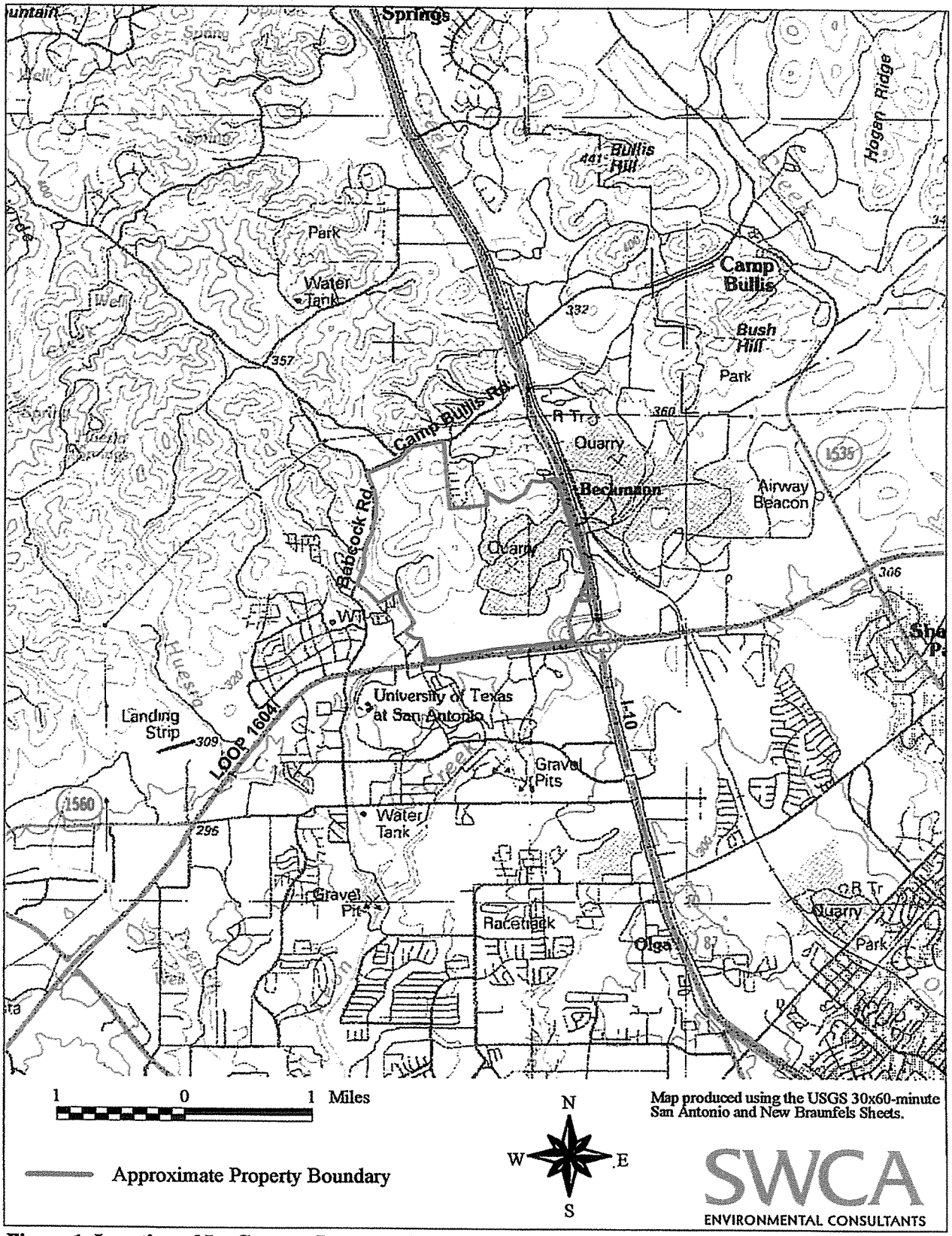


Figure 1. Location of La Cantera Property, Bexar County, Texas.

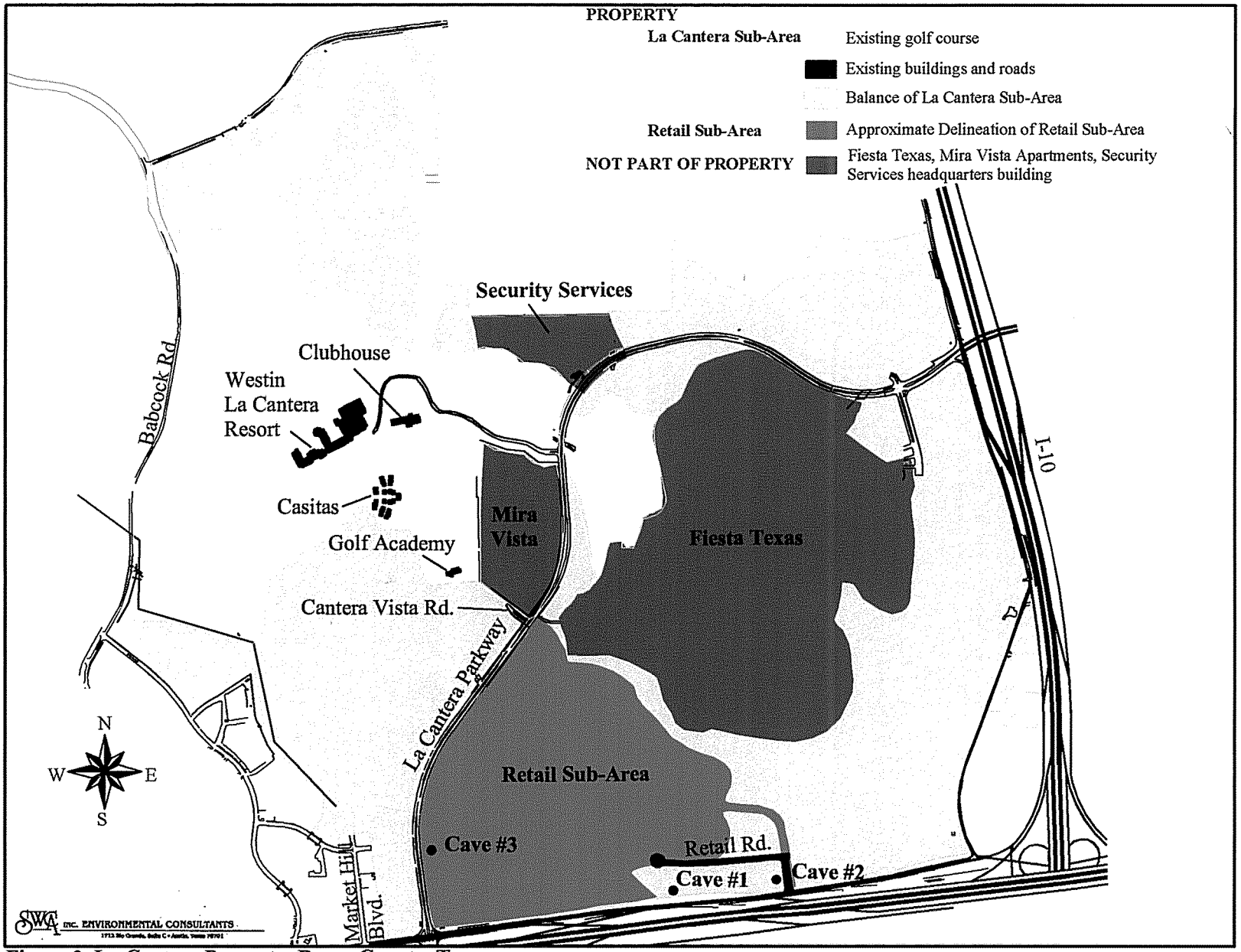
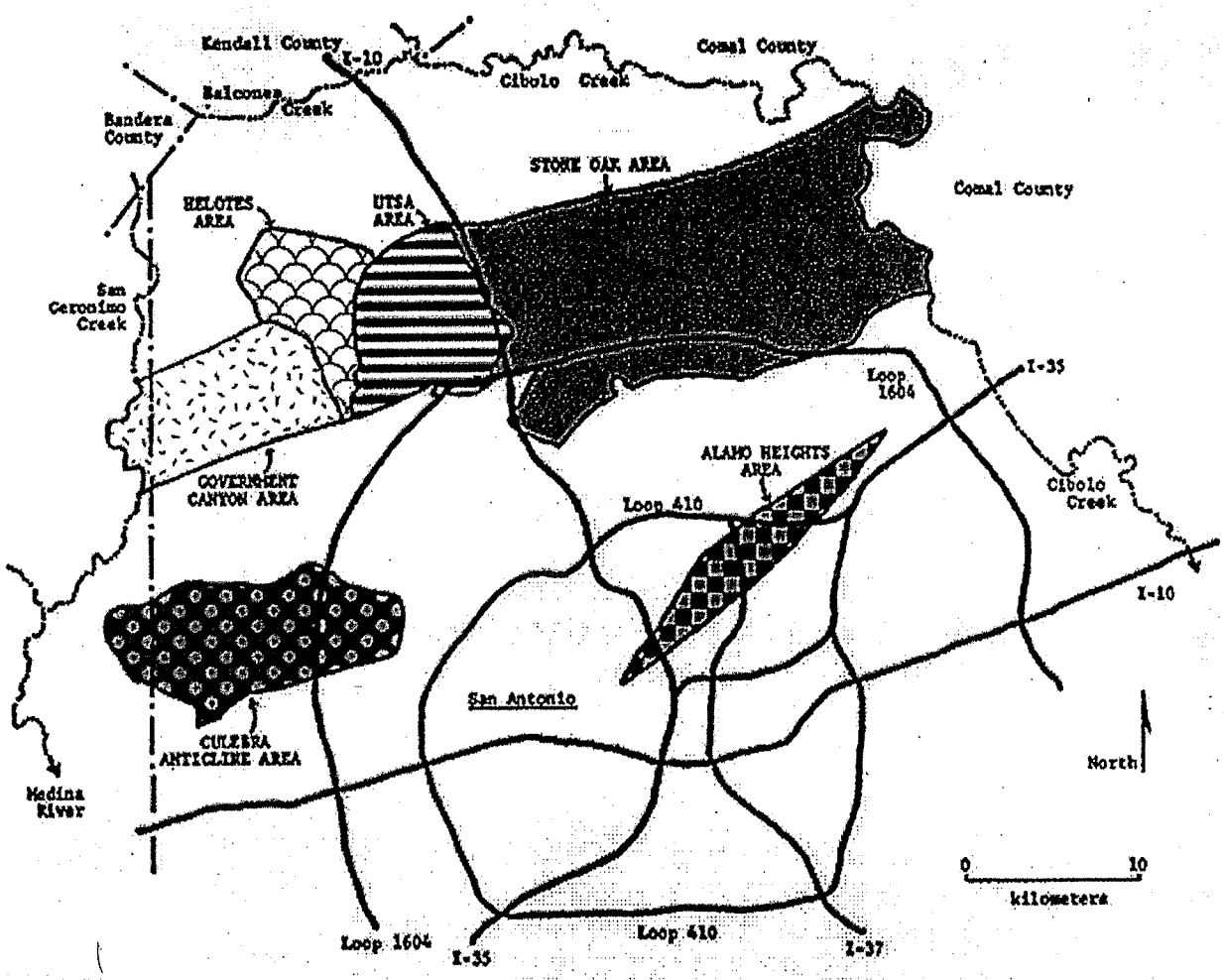


Figure 2. La Cantera Property, Bexar County, Texas.

Figure 3: Bexar County Karst Fauna Regions



3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

The Property lies within the northern portion of the City of San Antonio which is being increasingly developed by commercial and residential growth. The City of San Antonio has been expanding towards the north over the last several years because of desirable residential and commercial locations within the Hill Country and existing infrastructure. With the prospective growth comes new housing and commercial developments, improvements in infrastructure, and an increased tax base to Bexar County and the City of San Antonio.

The Property is situated within a master planned development, which includes the existing Westin La Cantera Resort and Golf Club present on its northwest side and Fiesta Texas, a theme park, present in an abandoned quarry immediately adjacent to the Property. With the increasing demands for housing and employment, the area is attractive for residential and commercial/retail development.

3.1 Vegetation

Topography of the Property primarily consists of rolling hills with gentle to moderately steep slopes. The southern portion of the Property, roughly south of the southern limit of Fiesta Texas, is relatively flat and slopes gently uphill to the north. Leon Creek passes through the southeast corner of the Property and a well-developed unnamed drainage runs along its west side (Figure 1).

Uplands on the rolling hills primarily support semi-open to dense woodland dominated by Ashe juniper (*Juniperus ashei*) and live oak (*Quercus virginiana*). Most trees in these woodlands range in height from 15-20 feet, with some live oak trees up to 30 feet in height. Tree heights generally decrease upslope, although some hills are capped with patches of taller trees. Bumelia (*Bumelia lanuginosa*) trees, approximately 12-17 feet in height, are present in these woodlands in very low densities. Trees generally occur in bands that follow topography, with these bands separated by narrow grassy clearings. Shrub densities are generally very low in clearings and within woodlands, although low to moderately low densities of shrubs are developed on some south-facing slopes along the edges of clearings, ranch roads, and powerline rights-of-way. Shrub species found present during SWCA site visits include evergreen sumac (*Rhus virens*), agarita (*Berberis trifoliolata*), prickly pear (*Opuntia lindheimeri*), twistleaf yucca (*Yucca rupicola*), catclaw acacia (*Acacia roemeriana*), Texas persimmon (*Diospyros texana*), sotol (*Dasylirion texanum*), bluewood condalia (*Condalia hookeri*), kidneywood (*Eysenhardtia texana*), Spanish dagger (*Yucca treculeana*), and mountain laurel (*Sophora secundiflora*).

A south-facing hillside on the southwest side of the Property supports scrubbier woodland with a moderate density of evergreen sumac and lower densities of live oak than present in other hilly areas. Ashe juniper is shorter in this area, mostly 6-12 feet tall. Other previously mentioned shrub species are also present in this area in very low densities.

Uplands southeast of Fiesta Texas support shrubby woodland composed primarily of Ashe juniper, live oak, evergreen sumac, sotol, and prickly pear. Other species present in lower

densities include hog-plum (*Colubrina texensis*), agarita, and Spanish dagger. Ashe juniper and live oak trees in these areas mostly range from 4-12 feet in height.

Flatter areas in the southwest corner of the Property, from the western Property boundary east to a fenceline that lies roughly 1,000 feet east of La Cantera Parkway, appear to have been historically cleared of woody vegetation, probably to facilitate cattle grazing. West of La Cantera Parkway, the flatter area supports open scrubby live oak/Ashe juniper woodland. Most live oak trees range in height from 20-35 feet and most Ashe juniper trees are 7-15 feet tall. Thickets of live oak saplings are present throughout, with heights of these thickets generally decreasing to the north from a maximum of about 8-12 feet down to 3-5 feet. Other tree species, mostly cedar elm (*Ulmus crassifolia*) and hackberry (*Celtis laevigata*), are present in very low densities and represented by individuals up to 15 feet in height. Shrub species are present in moderately low to moderately high densities. Common species include Texas persimmon, prickly pear, evergreen sumac, twistleaf yucca, and agarita, with evergreen sumac largely restricted to the northern third of the area. Other less common species present include Buckley yucca (*Yucca constricta*), hog-plum, lace cactus (*Echinocereus caespitosas*), and catclaw acacia. Open areas between trees and shrubs support a well developed grass cover.

From La Cantera Parkway to the easternmost boundary, the flatter area also supports open live oak/Ashe juniper woodland, but with much lower densities of shrubs. Most Ashe juniper trees are 6-10 feet in height and most live oak trees are 18-22 feet tall. Hackberry trees up to 20 feet tall are present in low densities throughout the woodland. Shrubs present in this area include prickly pear, hog-plum, agarita, bumelia, and evergreen sumac.

Remaining flatter areas, east of the fenceline to Leon Creek and between Fiesta Texas and Loop 1604, primarily support live oak/Ashe juniper woodland that ranges from semi-open to dense. Average canopy height generally increases to the south from roughly 14-18 feet up to about 20- 25 feet. Hackberry, mesquite (*Prosopis glandulosa*), and huisache (*Acacia farnesiana*) trees are present in low to moderately low densities in more open areas. Shrub species common in this woodland include agarita, Texas persimmon, prickly pear, and bluewood condalia; less common shrub species present include whitebrush (*Aloysia gratissima*), Spanish dagger, pencil cactus (*Opuntia leptocaulis*), and cat-claw acacia.

The unnamed drainage running along the western Property border is relatively broad and, while ephemeral, appears to occasionally carry large flow volumes as the channel bottom contains much debris and primarily supports grasses and other herbaceous species, as well as some Roosevelt weed (*Baccharis neglecta*). Some medium to large-sized trees are present in a narrow line along the west side of the lower reach of this drainage. Species present include live oak, Ashe juniper, cedar elm, eastern cottonwood (*Populus deltoides*), willow (*Salix nigra*), and Texas oak (*Quercus buckleyi*). Open disturbed areas are present to the east of this portion of the drainage. These areas are primarily grassy with scattered mesquite and huisache trees and a few evergreen sumac, bluewood condalia, and Mexican buckeye (*Ungnadia speciosa*) shrubs.

The middle reach of the drainage passes through the golf course and has been modified to accommodate golf course construction. The upper reach of the drainage is also open and grassy,

but the channel is not as wide as in the lower reach. This portion of the drainage is lined with Ashe juniper and Texas oak trees ranging from 8-25 feet in height. Common shrub species present along the drainage include evergreen sumac and Roosevelt weed; less common species present include agarita, catclaw acacia, live oak, Mexican silk-tassel (*Garrya ovata*), and Carolina buckthorn (*Rhamnus caroliniana*). The slopes of tributaries of the drainage in the northwest portion of the Property support Ashe juniper/live oak woodland with low densities of Texas oak and shin oak (*Quercus sinuata* var. *sinuata*) trees and a sparse understory of Mexican silk-tassel, Carolina buckthorn, sotol, agarita, twistleaf yucca, and Texas persimmon.

Leon Creek possesses a wide, open rocky channel that supports tall grasses and Roosevelt weed. Live oak/Ashe juniper woodland borders the creek to the east and a large rocky ledge borders it to the west. Live oak and cedar elm trees are present in moderately low densities and Texas oak trees are present in low densities on the west side of the drainage. Shrub species present on the west side of the drainage include Spanish dagger, whitebrush, mountain laurel, Mexican silk-tassel, Mexican buckeye, and poison ivy (*Toxicodendron radicans*).

Review of aerial photography contained in the Soil Survey of Bexar County indicates that in the 1950s, hilly portions of the land comprising the Property supported semi-open woodland, probably primarily composed of Ashe juniper and live oak as it is currently. Flatter portions of the Property primarily supported open pastureland (Soil Conservation Service 1962).

3.2 Wildlife

In general, wildlife on the Property is typical of juniper/live oak woodlands/scrublands in central Texas. Common mammals on the Property are expected to include opossum (*Didelphis virginiana*), armadillo (*Dasypus novemcinctus*), fox squirrel (*Sciurus niger*), Texas mouse (*Peromyscus attwateri*), white-ankled mouse (*Peromyscus pectoralis*), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginiana*). Common permanent resident bird species include turkey vulture (*Cathartes aura*), northern bobwhite (*Colinus virginianus*), mourning dove (*Zenaida macroura*), ladder-backed woodpecker (*Picoides scalaris*), western scrub jay (*Aphelocoma coerulescens*), tufted titmouse (*Baeolophus bicolor*), Bewick's wren (*Thryomanes bewickii*), northern mockingbird (*Mimus polyglottos*), northern cardinal (*Cardinalis cardinalis*), rufous-crowned sparrow (*Aimophila ruficeps*), and house finch (*Carpodacus mexicanus*). Common reptiles and amphibians in the area include Gulf Coast toad (*Bufo valliceps)*, Texas earless lizard (*Cophosaurus texanus*), ground skink (*Scincella lateralis*), Texas rat snake (*Elaphe obsoleta*), Texas patchnose snake (*Salvadora grahamiae*), and flathead snake (*Tantilla gracilis*) (Kutac, et. al.,1994).

Both La Cantera caves #1 and #2 contain the rare, troglobitic, earwig-like *Mixojapyx* sp. This species is only known from four other caves in Bexar County and only one cave each from Comal, Kimble, Menard, and Travis counties (Veni and Reddell, 1999).

3.3 Listed, Proposed and Candidate Species

Eleven endangered species occur within Bexar County and/or the general project region. These

species include two songbirds, black-capped vireo (*Vireo atricapillus*) and golden-cheeked warbler (*Dendroica chrysoparia*), and nine cave-dwelling invertebrates, Madla Cave meshweaver (*Cicurina madla*), Robber Baron Cave meshweaver (*Cicurina baroni*), Government Canyon Bat Cave meshweaver (*Cicurina vespera*), Braken Bat Cave meshweaver (*Cicurina venii*), Government Canyon Bat Cave spider (*Neoleptoneta microps*), Cokendolpher cave harvestman (*Texella cokendolpheri*), Helotes mold beetle (*Batrisodes venyivi*), and two species of ground beetles without common names (*Rhadine exilis* and *R. infernalis*).

Of these species, only *Rhadine exilis* is known and *Cicurina madla* is likely to occur on the Property.

In addition, another nine species listed as threatened, endangered or candidate species reside in the San Marcos and Comal aquatic ecosystems and the San Antonio Segment of the Edwards (Balcones Fault Zone) Aquifer. Seven of these species are endangered: Peck's cave amphipod (*Stygobromus pecki*), Comal Springs riffle beetle (*Heterelmis comalensis*), Comal Springs dryopid beetle (*Stygoparnus comalensis*), San Marcos gambusia (*Gambusia georgei*), fountain darter (*Etheostoma fonticola*), Texas blind salamander (*Typhlomolge rathbuni*), and Texas wild-rice (*Zizania texana*). In addition, the San Marcos salamander (*Eurycea nana*) is listed as threatened. These eight species are known locally as "Edwards Aquifer Species." The Cagle's map turtle (*Graptemys caglei*), restricted almost exclusively to the Guadalupe and San Marcos Rivers approximately 32 miles north and 48 miles east of the Property, is also influenced by flows from the Edwards Aquifer and is listed as a candidate species. The Property is located within the Edwards Aquifer recharge zone.

Black-capped vireo: Surveys specifically designed to determine the status of black-capped vireos were conducted on the Property during U. S. Fish and Wildlife Service (Service) approved survey seasons from 1991 through 1996 by SWCA, Inc. In 1991, surveys for the black-capped vireo were conducted over 8 days. During these surveys, two male black-capped vireos were observed on the east side of the Property. In 1992, surveys were also conducted over 8 days. During these surveys, one male vireo was observed on the northeast side of the Property. Surveys were conducted on 11 days in 1993, 8 days in 1994, 9 days in 1995, and 5 days in 1996. No black-capped vireos have been reported on the Property since 1992. Black-capped vireos are migratory songbirds present in Texas only during their breeding season from March to August. Typical vireo breeding habitat in central Texas consists of areas with thin soil and limestone bedrock that support scrubby vegetation dominated by broad-leafed shrubs. Shin oak or evergreen sumac is usually common in areas occupied by vireos in central Texas. Other plant species often present in vireo habitat include Texas persimmon, agarita, Ashe juniper, live oak, and flame-leaf sumac (*Rhus lanceolata*). Foliage volume in vireo habitat is generally high from about 6-8 feet in height down to ground level; vegetation occupied by vireos usually has a relatively open upper canopy layer. Habitat matching the above description is rare on the Property and black-capped vireos are not expected to occur. The vegetation in the area on the east side of the Property where the vireos were observed in 1991 has since matured and is no longer suitable for vireos. By letter dated April 21, 1997, the Service stated that the development of the La Cantera property would not impact black-capped vireos.

Golden-cheeked warbler: Surveys specifically designed to determine the status of the golden-cheeked warbler on the Property were conducted from 1991 through 1993 by SWCA. No golden-cheeked warblers have ever been found on the Property and no suitable habitat is present. By letter dated April 21, 1997, the Service stated that the development of the La Cantera property would not impact golden-cheeked warblers.

Bexar County Karst invertebrates: On December 26, 2000, the Service published a final rule and determined nine cave-dwelling invertebrates from Bexar County, Texas, to be endangered species under the authority of the Endangered Species Act of 1973, as amended. *Rhadine exilis* (no common name) and *Rhadine infernalis* (no common name) are small, essentially eyeless ground beetles. *Batrisodes venyivi* (Helotes mold beetle) is a small, eyeless beetle. *Texella cokendolpheri* (Robber Baron Cave harvestman) is a small, eyeless harvestman (daddy-longlegs). *Cicurina baronia* (Robber Baron Cave meshweaver), *Cicurina madla* (Madla Cave meshweaver), *Cicurina venii* (Braken Bat Cave meshweaver), *Cicurina vespera* (Government Canyon Bat Cave meshweaver), and *Neoleptoneta microps* (Government Canyon Bat Cave spider) are all small, eyeless or essentially eyeless spiders.

These nine invertebrates are obligate (capable of surviving in only one environment) karst or cave-dwelling species (troglobites) of local distribution in karst terrain in Bexar County, Texas. Habitat required by the nine karst invertebrate species consists of underground, void spaces that maintain high humidity and stable temperatures. The surface environment of karst areas is also an integral part of the habitat needed by the animals inhabiting the subsurface areas. While the life habits of the nine invertebrates are not well known, the species probably prey on the eggs, larvae, waste, carcasses and/or adults of other cave invertebrates. In 1993, the Service contracted for two studies: one study (Veni and Associates 1994) discusses the overall karst geography in the San Antonio region and the potential geological and geographical barriers to karst invertebrate migration (on an evolutionary time scale) and limits to their distribution, and the other study (Reddell 1993) summarizes the distribution of the nine invertebrates known at that time.

Veni and Associates' (1994) report delineates six karst areas (karst regions) within Bexar County (Figure 3). The karst regions are as follows: Stone Oak, UTSA, Helotes, Government Canyon, Culebra Anticline, and Alamo Heights. The boundaries of these karst regions are geologic or geographic features that may represent obstructions to troglobite movement (on a geologic time scale) which have resulted in the present-day distribution of endemic karst invertebrates in Bexar County. The Property is located within the UTSA karst region, which is bounded by Helotes Creek to the west, Leon Creek to the east, and the limits of exposure of karstic terrain to the north and south.

Veni and Associates (1994) and Reddell (1993) determined that only two of the now-listed species were present in the UTSA region, *R. exilis* and *R. infernalis*. Subsequent studies have also documented occurrence of Madla Cave meshweaver in the UTSA karst region outside the Property (J. Cokendolpher, pers. comm. 2000). Biota surveys conducted by SWCA in 1994, 1995, and 2000 in the three La Cantera caves resulted in discovery of eyeless *Cicurina* spiders and *Rhadine exilis*, but no *Rhadine infernalis*.

Troglobitic Spider Identification

Obtaining identifications of troglobitic spiders is difficult. Only a few arachnologists in the United States have the experience, reference collections, and literature available to recognize the families and genera of immature spiders from caves. Of these, probably only two individuals would attempt to identify specimens to species and then only if adults were present. Only one individual, Mr. James Cokendolpher, currently has the experience, comparative material, and unpublished manuscripts at hand to accurately identify troglobitic spiders from Texas caves. Mr. Cokendolpher has analyzed all available *Cicurina* spiders from the La Cantera caves. Once collected, additional difficulties are encountered in identifying specimens. Members of the genera *Cicurina* and *Neoleptoneta* have been divided into separate species based largely on differences in the morphology of the reproductive organs of adult specimens. Consequently, immature specimens are not currently identifiable to species level with certainty.

Genitalic features are considered diagnostic for species identifications because changes in the genitalia do not appear to be driven by cave environmental factors. Other anatomical features are influenced by convergent evolution associated with troglomorphy (elongation of appendages, loss of pigment, reduction or loss of eyes, etc.) and are not considered good features to be used in differentiating troglobitic spider species.

Currently, only the genitalia of mature females of eyeless *Cicurina* spp. are known well enough to be used for species identifications. Adult males may be identifiable someday after an extensive study of their genitalia is undertaken. Only a few males are known of *Cicurina* and therefore efforts to associate them with females of the same species have not been accomplished. Collections in the great majority of caves (at least 27 caves) in Bexar County known to contain eyeless *Cicurina* spp. have failed to produce specimens identifiable to species level.

In situations where collectors have only been able to acquire immature specimens, captive culturing to raise specimens to adulthood has had limited success. Success in rearing troglobitic *Cicurina* spp. has been less than satisfactory with the best success having been achieved with specimens that were captured while only one or two molts away from adulthood. On May 23, July 26, and August 13 and 20, 2000, more than a dozen live eyeless *Cicurina* sp. were collected in La Cantera Cave #1. On September 13, 2000, two live eyeless *Cicurina* sp. samples were collected from La Cantera Cave #3. These specimens were shipped and hand-delivered to James Cokendolpher to be reared for possible future species level identification. As of March 1, 2001, five of the specimens have survived, though none of them appears close to adulthood.

According to Cokendolpher (unpublished data) to date, eight eyeless species of *Cicurina* have been described from Bexar County and four are listed as endangered (*C. madla*, *C. venii*, *C. baronia*, and *C. vespera*). Of these, *C. madla* has the widest known distribution of endangered troglobitic spiders throughout the karst regions in Bexar County (Figure 4). It has been positively identified from eight caves (Christmas Cave, Headquarters Cave, Helotes Blowhole, Hills and Dales Pit, Lost Pothole, Madla Cave, Madla Drop Cave, and Robber's Cave). From these eight caves, only nine adult females have ever been collected. The known range of *C. madla* includes caves formed in both the Edwards and Glen Rose Limestone formations and

stretches from Government Canyon State Natural Area (Government Canyon karst region) through the Helotes and UTSA karst regions east to Camp Bullis Military Reservation in the Stone Oak karst region. The species is not known from the Alamo Heights and Culebra Anticline karst regions.

Based on the known distributions of listed endangered *Cicurina* in Bexar County, and the best scientific information available to us today, the populations present in the La Cantera caves are likely to belong to *Cicurina madla* and are very unlikely to be *C. baronia*, *C. venii*, or *C. vespera*. *Cicurina baronia* is known only from Robber Baron Cave in the Alamo Heights karst region. *Cicurina venii* is known only from Bracken Bat Cave in the Culebra Anticline karst region. *Cicurina vespera* is known only from Government Canyon Bat Cave in the Government Canyon karst region. The record of *C. vespera* from a cave 5 miles northeast of Helotes (USFWS 2000) was initially misidentified and that specimen has now been recognized as representing an undescribed new species (Cokendolpher, unpublished manuscript). The likelihood that the La Cantera cave species is *C. madla* is further supported by the recent confirmation of *C. madla* in Hills and Dales Pit and Headquarters Cave on Camp Bullis. It is also possible that the La Cantera eyeless spiders of the genus *Cicurina* represent an as yet undescribed new species, but no definitive confirmation is expected prior to consideration of issuing a permit and possible construction on the Property. Therefore, all further references to the identification of the Property's *Cicurina* sp., including the mitigation provided to the maximum extent practicable based on the best scientific information available, and proposed as part of the Preferred Alternative, are based on the premise that the eyeless *Cicurina* spiders found in the three La Cantera caves belong to *C. madla.*

Caves on the Property

Over 400 potential karst features have been evaluated on the Property. Three primary geological assessments have been performed in the past, and their combined scope has included the entire Property (Raba-Kistner 1993a and 1993b; SWCA 2000a; Horizon Environmental Services, Inc. 2000). The area surveyed by each company, as well as the scope of investigation, was different for each survey. Section I of the supporting documentation of the Habitat Conservation Plan (page 75 ff section 6.0, the HCP), which is available upon request, provides a summary of the karst invertebrate survey history and results, where appropriate, for each of the over 400 potential karst features identified on the Property. Where possible, correlations between the features have been made and are shown in Section I. The results of all of the surveys are given in Table I-15 in Section I. All but three of the features (La Cantera caves #1, #2, and #3) identified during the course of the karst surveys are considered insignificant with regard to endangered karst invertebrate habitat.

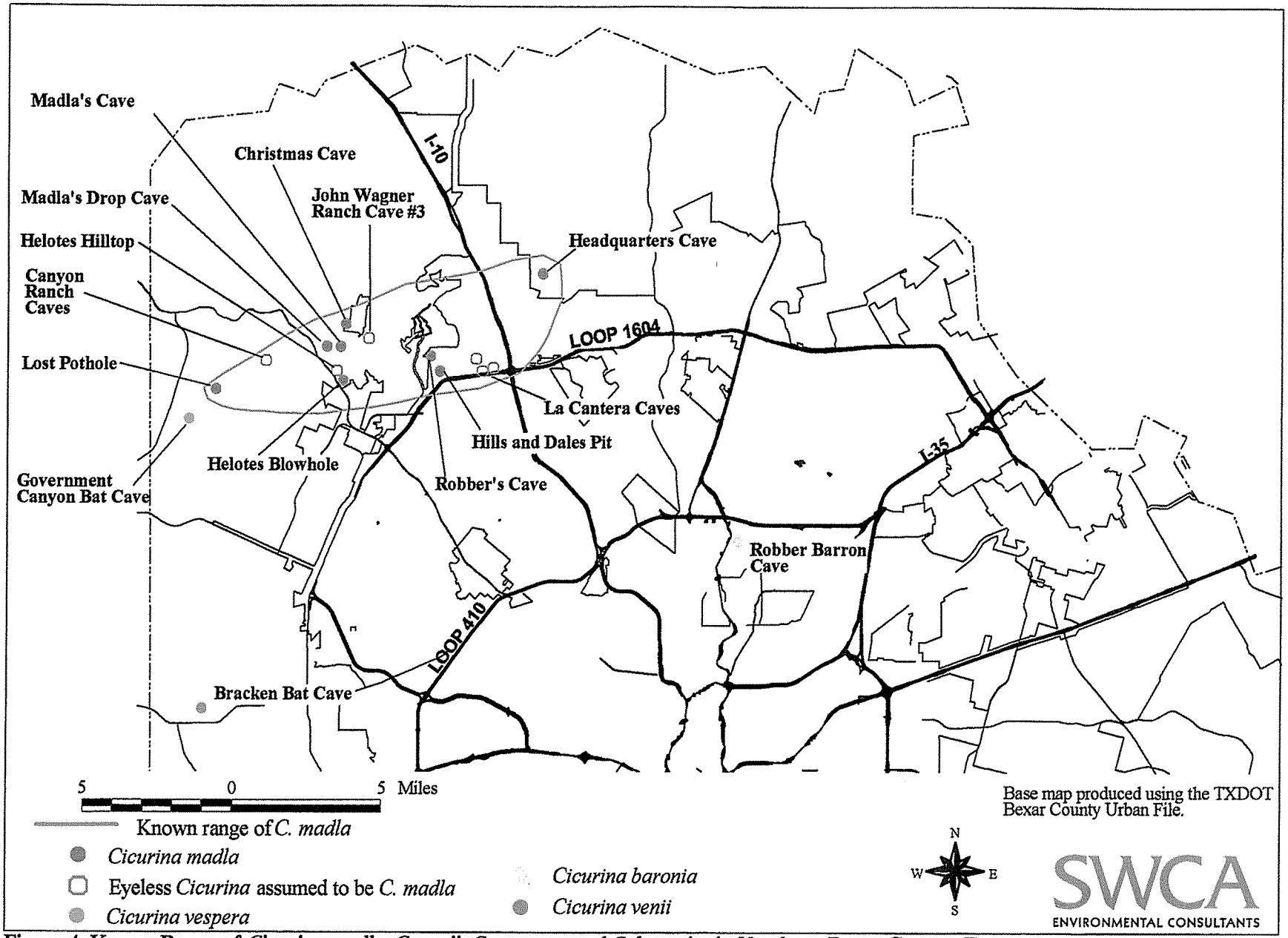


Figure 4. Known Range of *Cicurina madla, C. venii, C. vespera, and C. baronia* in Northern Bexar County, Texas.

Karst surveys began in 1993 when Raba-Kistner was contracted to conduct a Texas Natural Resources Conservation Commission (TNRCC) geologic assessment of a portion of the Property bounded by La Cantera Parkway to the west, Fiesta Texas to the north, Loop 1604 to the south, and Old Fredericksburg Road to the east (Raba Kistner 1993 a and b). During this survey, 200 potential karst features were identified, including a sinkhole that was later excavated by SWCA to reveal La Cantera Cave #3. A total of 89 of the karst features identified during the survey were described as fractured rock outcrops or faults and not likely to contain potential habitat for karst invertebrates.

SWCA was contracted in 1994 to conduct a karst feature survey to search for features on the entire Property with potential to provide habitat for the now endangered species. During this survey, 207 karst features were identified, including several features that had previously been identified in the Raba-Kistner geologic assessment. After the survey, SWCA excavated 41 karst features that were identified as meriting further evaluation with regard to potential karst invertebrate habitat. It was during these excavations that La Cantera Cave #3 was discovered and opened.

In 2000, Horizon was contracted by a potential developer to conduct a karst survey of 200 acres of the Property to the southwest of Fiesta Texas, east of La Cantera Parkway, and north of Loop 1604. The scope of the Horizon investigation was to conduct a detailed study of both aquifer recharge features and potential karst invertebrate habitat. Horizon identified approximately 28 insignificant karst features that had not been identified by Raba-Kistner or SWCA. No additional caves or subsurface voids were identified during the Horizon investigation.

Only three caves containing the listed karst invertebrates have been found. Two of these caves (La Cantera Caves #1 and #2) are known to contain *Rhadine exilis* and *Cicurina madla.* The entrances to both caves lie within 200 feet of the west-bound frontage road of Loop 1604, a heavily traveled road. Also, both caves are immediately south (approximately 100 ft.) of Retail Road, a two-lane road designed and constructed in 1999 to serve traffic to and from the commercial developments of La Cantera. The entrance to La Cantera Cave #3, which contains *Cicurina madla,* lies within 100 feet of La Cantera Parkway (Figure 2). Due to the proximity of all three caves to existing roadways, these features do not provide ideal conditions for long-term protection of the endangered invertebrates.

Karst Species and Their Habitats

The age of the Bexar County karst invertebrate species assemblage is unknown. Some authors have suggested that cave-adapted species may have evolved to their present form during the Pleistocene (1.8 million to 11,000 years ago) based on the assumption that subterranean void spaces were the only refugia available to invertebrates in areas covered by continental glaciers (Barr 1968; Pittman 1999), although no evidence suggests central Texas was covered by ice during this geologic epoch. Dating of speleothems in central Texas indicates these structures were actively forming during the Pleistocene (Musgrove 2000), suggesting that habitat was available for karst invertebrates at that time and further suggesting that the karst invertebrate species, or their ancestral species, could pre-date the Pleistocene. Occurrence of some species,

for example, *Rhadine exilis* and *Cicurina madla* in multiple karst regions in Bexar County may provide some evidence of the antiquity of these species as the species had to have dispersed to their current ranges prior to isolation of the karst regions by stream dissection.

Because sunlight is absent or only present in extremely low levels in caves, most karst ecosystems depend on nutrients derived from surface plant and animal communities. These ecosystems receive nutrients from the surface in the form of leaf litter and other organic debris that is washed or falls into cave entrances, tree and other vascular plant roots that penetrate cave ceilings, and the feces, eggs, and dead bodies of trogloxenes (animals that shelter in caves but leave on a regular basis to feed on the surface) (Barr 1968; Poulson and White 1969; Howarth 1983). Relative importance of each of these nutrient sources is not well understood and may vary from cave to cave.

Cave crickets (*Ceuthophilus* sp.) are important providers of nutrients (Barr 1968) and are found in most caves in Texas (Reddell 1966); they forage on the surface at night and lay eggs and shelter in caves during the day. A variety of troglobites are known to feed on cave cricket eggs (Mitchell 1971b), feces (Barr 1968; Poulson et al. 1995), and/or on the adults and nymphs directly (Elliott 1994, Cokendolpher unpublished manuscript). One study indicates that cave crickets can forage at distances greater than 164 feet from cave openings (Elliott 1994).

Daddy-longlegs harvestman (*Leiobunum townsendi*) is another widespread trogloxene commonly found in Texas caves (Reddell 1965). It, and other surface invertebrates, may enter caves and contribute nutrients to karst ecosystems. Other trogloxene species that could contribute nutrients to karst ecosystems include, but are not limited to, snails, earthworms, pillbugs, scorpions, spiders, mites, springtails, bristletails, harvestmen, silverfish, ants, leafhoppers, thrips, beetles, weevils, moths, and flies (Reddell 1965 and1966).

Raccoons and other small mammals, as well as several species of reptiles and amphibians that shelter in caves in Texas (Reddell 1967), can provide nutrients to karst ecosystems. The feces and dead bodies of vertebrates can promote the growth of microbes and fungi that can then be fed upon by springtails, which are an important food source for some predatory troglobites. In low densities, these species provide a source of nutrients for karst ecosystems. However, their presence in high densities could possibly be detrimental to the karst ecosystem.

Surface plant communities support the karst ecosystem both directly and indirectly. Dead and decaying plant material can fall or be washed into caves. Root masses reaching cave interiors and/or openings through soil and rock fissures may also provide direct nutrient input to shallow caves (Howarth 1983 and 1988). A survey of 21 caves on the Edwards Plateau revealed that roots of six tree species reached cave interiors (Jackson et al. 1999). Maintaining a balanced native woodland community over the caves is needed to support this direct nutrient input.

Indirectly, the plant community also supports karst ecosystem dynamics by providing the habitat matrix used by surface animal communities for food, forage and shelter. Nutrient are contributed by mammals, invertebrates, amphibians, and reptiles. Generally, when plant species composition is altered, subsequent changes also occur in animal communities (Lovejoy and Oren 1981; Harris

1984; Mader 1984; Thompson 1985; Lovejoy et al. 1986; Yahner 1988; Fajer et al. 1989; Kindvall 1992; Tscharntke 1992; Keith et al. 1993; Hanski 1995; Lindenmayer and Possingham 1995; Bowers et al. 1996; Hill et al. 1996; Kozlov 1996; Kuussaari et al. 1996; Turner 1996; Mankin and Warner 1997; Burke and Nol 1998; Didham 1998; Suarez et al. 1998; Crist and Ahern 1999; Kindvall 1999). Changes in plant species composition may lead to potentially negative effects on both cave species and nutrient cycling processes important to cave dynamics.

In addition to providing nutrient input, the surface plant community buffers the karst ecosystem from changes in temperature and moisture regimes, pollutants entering from the surface (Biological Advisory Team 1990; Veni and Associates 1988), and other factors such as sedimentation from soil erosion. Preserving native vegetation also helps control certain exotic species, such as red-imported fire ants (*Solenopsis invicta*) (Porter et.al 1988), that compete with and/or prey upon the listed species and other karst fauna.

Troglobites generally require stable, mild temperatures, and constant, high humidity (Barr 1968; Mitchell 1971a). Temperatures in caves are typically the average annual temperature of the surface habitat and vary much less than the surface environment (Howarth 1983; Dunlap 1995). Elliott and Reddell (1989) reported that relative humidity is typically near 100% in caves supporting troglobitic invertebrates. Many of these species do not possess the adaptations needed to prevent desiccation in drier habitats (Howarth 1983) or the ability to detect and/or cope with more extreme temperatures (Mitchell 1971a). To maintain adequate climatic conditions, it is important to maintain an adequate drainage area to supply moisture to the cave and connected karst areas, and to maintain the surface plant communities that insulate the karst system from excessive drying and more extreme temperature fluctuations.

Water enters karst ecosystems through the surface and subsurface. Because these karst ecosystems depend on air-filled voids with some water infiltration, a reduction in moisture levels can eliminate troglobitic fauna, since they rely on moist air environments. Increased moisture levels can result from flooding and can eliminate of air-breathing species. Water infiltration also brings nutrients into the subsurface system, and thus alteration of the quantity of surface water inflow may also change nutrient inflow. The karst invertebrate species appear able to survive periodic flooding of their caves since some occur in recharge features that take in considerable amounts of water during heavy rain events. In these cases, invertebrates may use interstitial spaces (small voids in the rock that are unenterable by humans but used by cave invertebrates) to escape the flooding, or they may survive periods of innundation. However, these invertebrate species rarely occur in stream-bed karst features that are frequently inundated by water.

Caves may be connected to other subterranean habitats to constituting single functioning systems. Interstitial spaces may connect two or more caves (from the perspective of an invertebrate), they may surround a single cave (effectively enlarging the habitat and potential area impacted by surface activities), or they may occur independent of humanly enterable caves. During periods of dryness or temperature extremes, the troglobites may retreat into these interstitial spaces, where the physical environment is more stable (Howarth 1983).

Threats to Karst Invertebrate Species

Habitat Loss

A primary threat to endangered karst species is loss of habitat due to development activities. This loss may occur from filling cave entrances or collapse of cave ceilings due to construction activities; alteration of natural drainage patterns (by activities such as altering topography, increasing impervious cover, installing berms or water collecting devices) resulting in drying or flooding; loss or degradation of surface plant and animal communities resulting in changes to moisture, temperature, or nutrient regimes of the karst ecosystem or increases in predation and/or competition; pollution; and increased human visitation, vandalism, and dumping.

Filling in or collapsing of karst features threatens the karst invertebrates directly by killing individuals and destroying vital habitat. Disturbance of karst features also reduces or may totally block input of nutrients and moisture. Larger trogloxene species may lose access to caves and even if smaller trogloxenes such as cave crickets are still able to access a partially filled cave, habitat quality may be degraded by increasing the crickets' cost of foraging which may decrease the number of cave crickets present (Helf et al. 1995).

Negative Effects on Drainage Quality and/or Quantity

Drainage patterns of karst features may be changed during construction by it altering topography and flattening the landscape; adding curbs, berms, drainage ditches, or storm drains; or, by increasing impervious cover (the surface area covered by buildings, roads, parking lots, or other construction, that impedes normal rainwater infiltration into the soil and epikarst) over the drainage area of the cave. These alterations can lead to either an increase or a decrease in the total amount of water flow into a cave, or they may change the rate or periodicity of water flow into the cave. Impervious cover prevents the natural process of water percolating into the ground, moving slowly toward aquifers, and being partially taken up by plants. If added runoff from impervious cover is drained towards the cave, the frequency and magnitude of flooding to the cave could be increased, and the added runoff could also carry contaminants into the karst system.

Caves are susceptible to pollution from contaminated water entering the ground, because the honeycombed karstic limestone has little capacity for water filtration. Pollutants may be derived from urban run-off; pesticides and fertilizers that are broadcast, sprayed, or fogged; hazardous materials; pipeline and storage tank leaks; power transformer and industrial accidents; leakage from septic systems, landfills, and sewer lines; and other sources. Karst systems can also be contaminated by sedimentation caused by soil erosion that accompanies development and clearing of vegetation. Primary routes of contaminant entry into karst ecosystems include the surface and subsurface drainage basin of a karst ecosystem; air (for airborne contaminants); and disposal of household garbage, construction debris, motor oil, and other materials directly into cave entrances. Such items may either be toxic, or the excess organic waste may alter the nutrient balance of the cave and increase levels of competing species from the surface (Culver 1986). The surface and subsurface drainage basin that supplies water to the ecosystem has the greatest potential to carry contaminants into the karst. However, the potential for contaminants

to travel through karst systems outside these basins may be extensive in some cases. For example, hydrocarbon fumes were detected in three caves up to 1.7 miles northeast of the site of a major oil spill in south Austin in 1987, despite cleanup efforts (Russell 1987). It should be noted that the surface drainage basin of a cave can be determined fairly easily through analysis of surface topography around any entrances to the cave (including micro-entrances above the cave footprint). In contrast, the subsurface drainage basin includes flow routes that require more extensive analysis to identify and may be extremely different than the surface drainage basin.

In addition to the aforementioned issue of contaminants, there may be complications associated with detection of contaminants due to time lags between contamination events and monitoring. Cave systems can act as sewers that efficiently transport contaminants over miles in short time periods. Contaminants that sweep through can impact the fauna, then flush out, so that subsequent monitoring does not detect those contaminants. Conversely, contaminants can be stored in areas that are not monitored (such as interstitial epikarstic zones, walls and ceilings of cave passages, sediments) for many years after events before they are finally pushed out of the cave system. Those contaminants can impact the cave organisms during their residence in the system, yet go unnoticed in water samples. Because it is extremely difficult and costly to continually monitor all of these potentially impacted areas, this can complicate the assessment of the impact and the management of the resource.

Vegetation Alteration

Direct removal of native vegetation or development-induced changes in microclimate can lead to shifts in plant communities, which in turn may lead to shifts in animal communities. Such removal of native vegetation may result in increased temperature of the surrounding surface environment with a concomitant shift in surface faunal and floral communities (effects may include an increase in non-native plant and animal species, increased exposure to wind for the surface community and cave entrance, increased drying of the surface community, and the increased potential for sedimentation from soil erosion).

Exotics

Fire ants, which prefer open, sunny areas where soil and vegetation have been disturbed, also pose a serious threat to the listed karst species and the ecosystems on which they depend. The fire ant is an aggressive predator and has a devastating and long-lasting impact on native ant populations and other arthropod communities (Vinson and Sorenson 1986; Porter and Savignano 1990). The relative accessibility of the shallow caves inhabited by the listed invertebrates makes them especially vulnerable to invasion by fire ants and other exotic species.

Vandalism

People visiting caves can also damage the cave environment (Culver 1986). Even the most conservation-minded visitors to a cave can inadvertently kill individuals of listed invertebrate species or disrupt or destroy habitat by compacting substrate or disturbing cover objects in the process of moving through restrictive passageways (Crawford and Senger 1988). Less conservation-minded visitors may also leave dead batteries, spent carbide (a headlamp fuel), and cigarette butts, all of which are toxic and may kill the listed species or their prey species. Human vandalism may include littering with beverage containers, broken glass, and food wrappers,

graffiti, and urination and defecation [although the food web of troglobites frequently depends on guano, human feces may not be suitable for troglobitic invertebrates (see review in Howarth 1983)]. The addition of organic matter that is not a natural part of the system may lead to a change in community composition, including the introduction of new species that are detrimental to the cave (Howarth 1983).

Karst invertebrates are difficult to study and are limited in numbers. Consequently, detecting small, gradual changes in the populations of these invertebrates is impractical. While little quantitative data are available on the direct effects of trash dumping, vandalism, sealing, and other disturbances to karst invertebrates, there is substantial qualitative evidence indicating that the threats discussed herein are real, significant, and ongoing. Reddell (invertebrate biologist, in litt. 1993) and Elliott (cave and karst ecologist, in litt. 1993) both cite examples in which trash dumping, vandalism, and over-visitation have resulted in decreased observations of karst invertebrates in affected areas in caves of Travis and Williamson counties.

Edge Effects

Maintaining adequate areas of native vegetation is essential to prevent detrimental "edge effects" (for example, heating, drying, shift in species composition and abundance, increased predation/competition, invasion of exotic species, etc.). Edge effects are changes to the floral and faunal communities where different habitats (such as forest/pasture, forest clear/cut, or scrub/suburb) meet. The length of the edge, as well as the contrast in types of land cover between the habitats, each contribute to the amount of impact that an edge can produce (Smith 1990; Harris 1984). The more edge a habitat fragment or patch has, the larger the patch or fragment size needs to protect the core area from deleterious edge effects (Ranny et al. 1981; Lovejoy et al. 1986; Yahner 1988; Laurance 1991; Laurance and Yensen 1991; Kelly and Rotenberry 1993; Holmes et al. 1994; Turner 1996; Reed et al. 1996; Suarez et al. 1998).

Minimizing edge effects in preserve design can be accomplished by keeping the edge to area ratio low through increasing patch size (Holmes et al. 1994) and/or by using optimal preserve shapes. More circular preserves, or ones that are connected to other preserves, are preferable (Diamond 1975; Wilcove et al. 1986; Kelly and Rotenberry 1993; Wigley and Roberts 1997; Kindvall 1999).

For vegetation, documented edge effects extend inward from the margin from between 52 and 449 feet (Jiquan et al. 1992; Stefen and Fairweather 1997; Meiners and Steward 1999). These edge effects have included decreased density, elevated tree mortality, increased growth rates and recruitment of dominant species (Jiguan et al. 1992), increased proportion of exotic species, decreased proportion of native species (Stefan and Fairweather 1997), and changes in species richness and percent cover (Meiners and Steward 1999).

For surface animal communities, reported edge effects typically extend 164-328 feet or greater (Lovejoy et al. 1986; Wilcove et al. 1986; Laurance 1991; Laurance and Yensen 1991; Kapos et al. 1993; Andren 1995; Reed et al. 1996; Burke and Nol 1998; Didham 1998; Suarez et al. 1998). Edges and their associated effects often allow just enough disruption for invasive species to gain a foothold where the native vegetation had previously prevented their spread (Saunders et al.

1990; Kotanen et al. 1998; Suarez et al. 1998; Meiners and Steward 1999). The invasion of red-imported fire ants is known to be aided by "any disturbance that clears a site of heavy vegetation and disrupts the native ant community" (Porter et al. 1988).

Karst Preserve Design

Each cave and land use situation may vary, and for this reason possibilities exist for preserve designs to be different. It is also clear that in some cases of preserve design it is impossible to satisfy some design recommendations, such as minimum acreage, and in these cases other actions may be warranted to help insure the survival of the species. The Service believes that based on a review of the information mentioned above a minimum 500-ft radius from all karst features with listed species should be protected. This includes a core area that encompasses the minimum 164 ft. cave cricket foraging range and a buffer needed to protect the core area from edge effects. This area should also help protect other invertebrates (such as daddy longlegs), herpetofauna, and mammals that provide nutrients to the caves, as well as deter fire ant infestations.

When considering this core area that is used as foraging grounds for the trogloxenes, it is essential to also include the area necessary to maintain a native plant community on which the trogloxenes rely. Both trogloxene input and detrital input during flooding are reliant on a healthy native plant community. Based on a review of literature, in order to preserve minimum viable populations of the native plant community, an area of 69-99 acres is recommended.

In addition to this core area, and the area for the native plants, it is vital to protect the subsurface and surface drainage basin from contamination. Protecting the subsurface environment maintains humid conditions, stable temperature, and natural air flow in the cave. Delineation of subsurface basins should be based on a detailed and appropriate hydrologic investigation by a geohydrologist who is experienced both with karst systems and the geology of central Texas. Maintaining native plant communities around a cave aids in maintaining natural, environmental conditions in the cave by buffering karst features from drying, flooding, and temperature fluctuations. Protecting the drainage basins and maintaining presence of native plant communities also helps protect karst features from contamination and sedimentation. Restrictions on the placement of utilities such as sewers and fuel pipelines and on the use of chemicals including pesticides, herbicides, and fertilizers in and around karst drainage basins also helps protect karst ecosystems from contamination. The possible routes of contamination and difficulties associated with monitoring this were previously discussed (in the "Threats to Karst Invertebrate Species" section). The sizes of these basins are different at each site, and they need to be included within the preserve.

Finally, a maintenance and adaptive management program needs to be included as part of the preserve design.

3.4 Jurisdictional Wetlands

The U.S. Army Corps of Engineers (USACE) defines wetlands as "those areas that are inundated

or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (USACE 1987). The Property is generally upland in nature. A review of the National Wetlands Inventory for the Helotes and Castle Hills quadrangles did not result in locating any identified wetlands. In addition, the USACE has evaluated (December 8, 2000) relevant data and determined that the Property does not contain any areas subject to Section 404 of the Clean Water Act (USACE Project Number 200000672).

3.5 Geologic Features and Soils

The Property is located on the southern edge of the Edwards Plateau Physiographic Province which is composed of Cretaceous Period carbonate rocks that were exposed by stream dissection subsequent to uplift by the Miocene development of the Balcones Fault Zone. The Balcones Fault Zone is the most prevalent structural feature in the region, with a system of predominantly normal, nearly vertical faults that strike to the northeast in the subject area. The beds strike roughly parallel to the fault zone and dip to the southeast at less than one degree.

The Property lies within the Edwards Aquifer Recharge Zone. The recharge zone comprises the Edwards Group and overlying Georgetown Formation in the Bexar County area. The Edwards Group is subdivided into two formations, the Kainer and Person, and seven members. Surface geologic units present on the Property consist of four of the seven members, and these are the Kirschberg and Dolomitic members of the Kainer Formation and the Leached and Collapsed member of the Person Formation (Stein and Ozuna 1995). These lower Cretaceous units consist primarily of limestone and dolomite. All of these geologic members are conducive to the formation of karst features. "Karst" describes a type of terrain where much of the bedrock has been dissolved by water such that porosity and permeability levels are high and a significant percentage of surface water infiltrates the subsurface. Caves, sinkholes, and fractures enlarged by solution are some of the karst features that capture and transmit water underground. Karst features rapidly take water into the subsurface, generally with little or no filtration, which makes their groundwater systems very sensitive to surface activities and conditions.

Soils occurring within the Property are generally thin and rocky. Six soil series occur on the Property: 1) Crawford and Bexar stony soils, 0-5% slopes; 2) Krum complex, 2-5% slopes; 3) Lewisville silty clay, 1-3% slopes; 4) Pits and Quarries; 5) Tarrant series; and 6) Trinity and Frio soils, frequently flooded. Crawford and Bexar soils are typically non-calcareous, clayey soils that occur on broad, nearly level to gently undulating areas in northern Bexar County. Krum soils are typically moderately deep, clayey soils that occur in long, narrow valleys along the foot slopes below Tarrant and Brackett series soils. Lewisville silty clay soils are deep, calcareous soils that occur in long, narrow sloping areas along Leon Creek. Pits and Quarries soils occur in areas that have been used for gravel, sand, or clay pits, limestone or chalk quarries, or city dumps. Tarrant series soils are stony, calcareous, clay loams that occur on gently undulated to steep slopes. These soils cover a majority of the Property. Trinity and Frio soils are alluvial soils that are deep, calcareous, clayey soils that occur along nearly level flood plains of small streams (Soil Conservation Service 1962).

3.6 Land Use

The Property is part of a larger master planned development. Existing development within the master planned development includes the Westin La Cantera Resort and Golf Club, the Mira Vista Apartment complex, Security Service Federal Credit Union headquarters building , La Cantera Parkway, Retail Road, Cantera Vista Road, and Fiesta Texas (Figure 2). All of these developments were completed prior to the listing of the karst invertebrates and are not covered under this permit.

Much of the Property has been historically grazed and cleared of trees and brush. The southern boundary of the Property is adjacent to Loop 1604, a heavily traveled four-lane highway with both east- and west-bound frontage roads. The Property is bound to the north and west by residential development. The eastern boundary is adjacent to I-10, a heavily traveled, six-lane interstate with both north- and south-bound frontage roads.

3.7 Water Resources

All drainages on the Property are ephemeral. Surface water runoff from the Property flows directly or indirectly into Leon Creek. No permanent water bodies are present on the Property.

Most of the Property is in the Edwards Aquifer Recharge Zone. Most of the water for the proposed development will be supplied by San Antonio Water System (SAWS), under regulation of the Edwards Aquifer Authority. Additional water is supplied through on-site existing Trinity aquifer wells and irrigation ponds. The Applicant is not proposing to establish any new wells in the Trinity Aquifer or increase existing pumping capacity.

3.8 Air Quality

Bexar County and the San Antonio metropolitan area are currently full attainment areas for all air quality criteria pollutants of the Texas Air Control Board, TNRCC, and the Environmental Protection Agency. However, any changes in attainment standards could affect future attainment status.

3.9 Water Quality

The Property lies within the Leon Creek watershed and the Edwards Aquifer Recharge Zone. Quality of surface water on the Property is currently estimated to be good because of a well developed vegetative cover. However, catastrophic and chronic water quality problems and groundwater contamination may result from human activities in the recharge zone, land-based oil and chemical spills, leaking underground storage tanks, development over recharge features, and reduction in the water level of the Aquifer. The Aquifer underlies portions of Kinney, Uvalde, Medina, Bexar, Hays, and Comal Counties (Texas). The Service has expressed concern that the combined current level of water withdrawal for all consumers from the Aquifer adversely affects aquifer-dependent species located at Comal and San Marcos Springs during low flows. These

species depend on constant flows from springs that are directly influenced by the water levels and water quality of the Aquifer.

Although the aquifer quality falls within federal drinking water standards, contaminants have been found with greater frequency in the aquifer by the U.S. Geological Survey, including some wells with pollutant levels that exceed the standards. Reeves (1976) noted the occurrence of fecal coliform and fecal strep bacteria, and elevated nitrate and phosphate levels in some wells on the recharge zone. Most of these sites were near suburban developments. Buszka (1987) found elevated levels of nitrates, bacteria, volatile and nonvolatile organic compounds, and pesticides throughout much of the aquifer, but concentrated near Uvalde and San Antonio. Some of these sites were from a leaking landfill in San Antonio and from another point source contamination site in Uvalde, but many are too far removed to be firmly attributed to those sources and likely reflect other contaminant sources. Roddy (1992) reported similar results and additional contaminant localities. Rice (1994) found that 54 wells in Bexar County have reported mercury and chlorinated solvents. While only a few wells had contaminant levels above those permitted by drinking water standards, the presence of any compounds found in Edwards wells demonstrates the potential for aquifer contamination. As a result of these and other related factors that threaten aquifer water quality, the Edwards Underground Water District concluded (Kipp et al. 1993):

"The lack of adequate comprehensive standards and regulatory controls to protect the aquifer against water quality degradation, coupled with the rapid pace of development over the ERZ [Edwards aquifer recharge zone] *at this time, and presumably for some time to come, suggests that degradation of water in the Edwards aquifer is imminent."*

The Applicant is required to file a Water Pollution Abatement Plan (WPAP) associated with new development with TNRCC, since the proposed project is on the Edwards Aquifer recharge zone. While TNRCC's Edwards Aquifer Rules offer some protection for the aquifer (for example, they require removal of 80% of the average annual load of total suspended solids) we believe this level of stormwater treatment falls short of true "non-degradation" of water quality.

3.10 Cultural Resources

SWCA conducted cultural resource investigations on the Property between February 6–7 and May 30–31, 2001. Archaeological investigations were designed to examine any previously recorded archaeological sites on the Property and locate any unrecorded areas of cultural activity. This was completed through a background literature and records review and an archaeological pedestrian survey of the undeveloped portions of the Property. The central portion of the Property is developed, with the La Cantera golf course occupying approximately 250 acres. Therefore, there was no need to inspect that previously disturbed area. The remaining 750 acres of the Property is currently undeveloped and was subjected to an archaeological field survey.

Background Research

A background literature and records search of the Property area was conducted by an SWCA archaeologist. The search consisted of examining records at the Texas Archeological Research Laboratory (TARL) and the Texas Historical Commission (THC). Site files, relevant maps, and State Archeological Landmark (SAL) and National Register of Historic Places (NRHP) listings were investigated for previously conducted surveys and recorded archaeological sites located within or near the Property. Identifying and characterizing archaeological sites adjacent to the Property were done to: (1) obtain information on the types and nature of sites found in the area as an aid in interpreting site potential and site distributions in the region; and (2) to evaluate the possibility of a near-by site or sites extending onto the Property.

The results of the background review revealed no previously conducted formal surveys within the Property. One previous archaeological survey was conducted in 1990 along a portion of I-10 adjacent to the Property. The I-10 to Loop 1604 Cultural Resource Survey consisted of one mile of effected construction area, beginning one-half mile north of the Route 1604/I-10 intersection and continuing north for one mile along I-10. This survey, conducted by the State Department of Highways and Public Transportation in conjunction with the Federal Highway Administration, consisted of a pedestrian reconnaissance of the entire line and a surface analysis of any newly recorded sites (TARL files). One prehistoric archaeological site (41BX889) was recorded during this project.

Site 41BX889 is located west of I-10, within the Property boundaries, on the middle fork of Leon Creek (see map). This multi-component site was found through surface examinations and artifact recovery involved a random surface collection. The prehistoric component, determined to be an open campsite, was noted by an abundance of chert tools and fire-cracked rock on the surface. Among the artifacts collected were a groundstone slab fragment, biface fragments dating from the Late Archaic through the Late Prehistoric, retouched flakes, scrapers, and a few flakes. As noted by the recording archaeologist, tools greatly outnumbered flakes in the surface assemblage. The historic component of the site, dating from the late-19th to early-20th century, consisted of a scatter of historic glass and ceramics, including course earthenwares, embossed aqua bottle glass, and amethyst bottle glass. Since no features were found in the immediate vicinity, this component was interpreted as a historic trash dump. Due to time and fiscal constraints, SWCA conducted no subsurface excavations at the time. It was noted, however, that the site boundaries could extend west of the current site delineations.

Though no other formal surveys have been conducted within or adjacent to the Property, three other archaeological sites (41BX52, 41BX558, 41BX1064) have been recorded directly outside of the Property boundaries. Though recorded as a site in the TARL site records and plotted in the official Texas Site Atlas in 1994, no information was available on site 41BX1064, located south of Route 1604 and west of site 41BX52. The site file records at TARL and the survey records and report library at the THC are currently incomplete.

Site 41BX52, an Archaic campsite and possible quarry site, was recorded in 1970 by

archaeologists from the University of Texas at San Antonio Center for Archaeological Research (CAR) outside, and southeast of, the Property. The site was reported to CAR by state highway workers, who discovered the area during a vegetation clearing project. Upon inspection by the recording archaeologists, it was found that the site had been looted. After clearing, a few unidentifiable projectile point fragments and several chert nodules were found on the surface during a systematic surface collection. It was suggested, however, that the site contained stratified cultural deposits, since the light disturbances associated with the vegetation clearing uncovered projectile points and core fragments. It is suspected that this site was further compromised by the widening of Route 1604 in the mid-1970s. This site does not extend onto the Property.

Site 41BX558, located southwest of the Property and west of Chase Hill Blvd., was discovered during unrelated construction activities. This prehistoric quarry and lithic workshop was recorded by archaeologists from CAR in 1981 (TARL files). Among the artifacts recovered during the surface collection were numerous cores, chert flakes, a dart point stem (possibly Nolan), a dart point blade, preform fragments, scrapers, gravers, and denticulates. The Nolan point fragment, as well as the dart point blade, date the site to the Early Archaic period (ca.8800 to 6000 BP). No subsurface testing was conducted at that time. This site does not extend onto the Property.

Archaeological Reconnaissance Survey

Utilizing the background research and the proposed development plans of the Property, a pedestrian reconnaissance of the Property was completed. This survey consisted of two SWCA archaeologists closely examining all non-developed areas through a combination of vehicular reconnaissance and pedestrian evaluations. Previously recorded archaeological sites in the area were re-examined for remaining integrity and areas with a high potential for containing unidentified cultural sites, including Leon Creek and associated landforms, were specifically targeted for examination.

Inspection of sites 41BX52 and 41BX889 revealed that construction activities associated with I-10 and Route 1604 have obliterated all traces of these sites. Site 41BX52 was originally located adjacent to the extreme southeastern corner of the Property, not actually within the Property boundaries. Site 41BX889 was initially documented as being adjacent to I-10 just east of Fiesta Texas Drive. No artifacts or cultural remains were located in the reported areas and the topography indicated recent disturbances at both locations. It is suspected that these sites were compromised by the widening of Route 1604 in the mid-1970s. No additional archaeological work was recommended by SWCA in these areas.

The pedestrian survey of the remaining undeveloped land traversed various upland and upland margin topographic conditions, with numerous areas exhibiting varying amounts of human activity. Based on this pedestrian reconnaissance survey, it is apparent that the majority of the Property has been disturbed by recent development and heavy machinery activity. Evidence of disturbances from machinery is visible in the numerous bulldozer push piles observed throughout the entire Property. These push piles, many of which are overgrown with scrub and wildflowers,

consist of cleared brush and rock. Much of the undeveloped portions remaining on the Property have also been used as garbage dumps, evidenced by old appliances, scrap metal, and other debris.

The northeast portion of the Property, located between Fiesta Texas and I-10, currently contains a large San Antonio Water System (SAWS) water tank with associated above ground pipes and boundary fences. The construction of this tank has severely disturbed the natural stratigraphy in the area. Furthermore, bulldozer push piles of gravel and dislodged bedrock were observed across the top of the hill on which the SAWS water tank sits. An additional targeted land form in this general area consists of a large upland hill with extremely steep, rocky slopes. Located in the extreme northeastern corner of the Property, this hill is thickly vegetated with juniper, oak trees, and yaupon and is comprised of exposed limestone bedrock and limestone colluvium.

The crest of the hill represents the only viable location for potential cultural resources due to the significant slopes associated with this hill. A sparse, dispersed scatter of primary and secondary flakes (approximately 20), as well as tested materials, was observed across the top of the hill. No additional cultural resources were noted. Due to the extreme sparseness of the scatter and the lack of any tools, the area was not recorded as a formal archaeological site by SWCA. Furthermore, the lack of soil development (exposed bedrock is prolific across the top of the hill) on upland land forms is not a conducive environment for buried cultural materials or sites. No further archaeological investigations were recommended by SWCA for this area.

Remaining portions of undeveloped land along the eastern Property boundary (east and southeast of Fiesta Texas) have also been disturbed. One area contains numerous large concrete slabs. These terraced slabs are connected by concrete ramps and are riddled with iron ties and wires. It is assumed that this area was used as a storage area or machine hold during the quarry operation. Current conditions indicate that this site was abandoned many years ago, as the area has fallen into an advanced state of disrepair. In several areas, concrete house platforms and an abundance of domestic debris litter the surface. One house site is located directly southeast of the SAWS water tank. This area currently contains a concrete house platform and a high quantity of domestic refuse. Based on the material remains, the domestic structure was quite large and the household was composed of several contributing outbuildings and landscape features such as patios, walkways, and storage barns. Among the domestic debris was a refrigerator, a toilet, carpeting, a television, and domestic garbage. A cursory examination of the construction technology and the refuse indicates a mid-20th century construction date and a relatively recent destruction date.

A second concentration of domestic refuse in the eastern edge of the Property was found south of the SAWS water tank near Old Fredericksburg Road. This collection contains a wide variety of artifacts and cultural materials that span over a century in manufacturing age. The most prevalent surficial find, as with other sites in the area, was modern trash. Included in this category is a console television set, a refrigerator, and many glass bottles and plastic containers. Though the bulk of materials date to the past twenty years, several 19th century artifacts were found mixed within this context, such as an amethyst bottle neck with a string lip and cobalt

medicine bottle fragments with embossing. The assemblage also contains fragments of mid-late 19th century ceramics, such as transfer-printed whiteware and decalcomania. Though a partial makers mark was found on the bottom of one of the whiteware fragments, the exact manufacturing information could not be determined. A thorough search of the area revealed no architectural materials or domestic elements and very little intact cultural stratigraphy. It is therefore believed that all materials were dumped in this area in their currently mixed context and there is little to no archaeological integrity or importance. It was recommended by SWCA that no additional cultural investigations be completed in areas east and southeast of Fiesta Texas.

In the northwest portion of the Property (north of the La Cantera Hotel and Clubhouse) near the intersection of Babcock Road and Camp Bullis Road are two additional areas targeted during reconnaissance. One area consists of a small floodplain and the associated unnamed tributary of Leon Creek immediately southwest of the intersection of Babcock Road and Camp Bullis Road. Based on the large amount of observed mechanical disturbances, construction debris, and domestic refuse, this area appears to have been used as a local dumping ground for several years. Bulldozer push piles of brush, rock, and other debris litter the area, indicating substantial subsurface disturbances. Construction debris include large cement beams and concrete sills, iron rods, plastic pipes and numerous brick fragments. Domestic debris is not as prevalent, but a collection of glass beverage containers, plastic wrappings, and household furnishings indicate purposeful disposal. Because of altered topography and disturbed soils, no additional archaeological work was recommended by SWCA for this section.

The second area examined during reconnaissance of the northwest corner of the Property is a thickly vegetated upland ridge of exposed limestone bedrock. Located north of the La Cantera Hotel and east of the floodplain area described above, the extremely steep and rocky margins of this ridge overlook the unnamed tributary mentioned above. Furthermore, surrounding the base of this ridge are several La Cantera golf course greens that have altered the topography. In fact, the heads of several small drainages associated with the ridge have been altered by the construction of the golf course. The crest of the hill is littered with exposed bedrock and gravels. Similar to the large hill north of Fiesta Texas in the northeast corner of the Property, a sparse lithic scatter consisting of tested raw material (chert and cherty limestone) as well as primary and secondary flakes (approximately 15–25 specimens) was observed. No additional cultural resources were noted. Due to the extreme sparseness of the scatter and the lack of any tools, the area was not recorded by SWCA as a formal archaeological site. Furthermore, the lack of soil development (exposed bedrock is prolific across the top of the hill) on upland land forms is not a conducive environment for buried cultural materials or sites. No further archaeological investigations were recommended by SWCA for this area.

The southern portion of the undeveloped Property (all areas south of the hotel and Fiesta Texas) appears relatively undisturbed. Throughout the area, however, there is an old dirt road and evidence of bulldozer activity (push piles of brush and rock). Trash dumps are also scattered across the entire area and contain old appliances, furniture and other miscellaneous debris. The area is lightly forested with extensive exposures of limestone bedrock and very shallow, rocky soils. Due to the shallow soils and good surface visibility, only four shovel tests were excavated.

Shovel tests were located in areas that suggested the potential for deeper sediments. Subsurface probes revealed shallow rocky soils and were halted as soon as bedrock was encountered, an average of approximately 15 cm below ground surface. All shovel tests were culturally sterile.

SWCA archaeological investigations revealed several exposed chert beds in the dry creek channel running along the southern boundary of the Property near Seco Creek Road. These chert sources appear to have been purposefully altered and scavenged as source material. Additional evidence of prehistoric chert use can be seen across all of this southern portion, as a sparse, discontinuous scatter of chert flakes and tested raw material litters the ground surface. This area was carefully explored for archaeological significance and site integrity. Boundaries of the ephemeral scatter could not be delineated as chert debris and flakes of this variety are ubiquitous throughout the entire Property. Amidst the background noise of the sparse, discontinuous lithic scatter, a particularly concentrated area of flakes and tools was discovered approximately .5 km northeast (approximate bearing of 70 degrees) of the intersection of Seco Creek Road and Market Hill Road. In addition to a higher concentration of chert debris, several tools and tool fragments were observed. Because of the relatively higher concentrations of chert tool making debris and the presence of tools, this area was designated as archaeological site 41BX1457.

Site 41BX1457 is considered an unknown prehistoric lithic scatter/workshop approximately 40 m east-west x 50 m north-south. Numerous bifaces in varying stages of manufacture, chert cores, and utilized and/or modified chert debitage litter a 2000 m^2 area. Unmodified debitage dominates the assemblage with quantities in excess of 500 specimens. No temporally diagnostic artifacts or additional cultural materials were observed. The presence of fresh breaks on some of the chert debris, in conjunction with push piles of brush and rock, suggest the site area has been disturbed by heavy machinery. SWCA believes the low potential for buried cultural materials due to the soil and bedrock characteristics of the area, combined with the disturbed, surficial, and compressed nature of the site, 41BX1457 lacks noteworthiness and integrity. It was therefore recommended by SWCA that no further archaeological work be conducted at site 41BX1457. No other cultural remains were located during the pedestrian survey.

Since both of the previously recorded archaeological sites on the Property have been destroyed and no cultural remains of significance were found during the pedestrian reconnaissance survey, SWCA recommended that no further archaeological work be conducted on the Property.

3.11 Socioeconomic Environment

In 2000, the greater San Antonio area, which includes the extra-territorial jurisdiction, grew at an annual rate of 2.24%; current population numbers for the area are 1.64 million people, up from 1.3 million in 1990. Bexar County, in which the Property occurs, has had steady growth in the 1990s in the range of 1.2% to 2.3% per year; current population in the county (outside San Antonio city limits) stands at 1.46 million, up more than 25% since 1990, when the population was 1.16 million (City of San Antonio Planning Department).

Military, service, telecommunications, trade, and construction are the primary employment sectors according to the City of San Antonio Planning Department. Primary employers in the greater San Antonio area include USAA insurance company, HEB grocery stores, SBC Communications and West Telemarketing. Unemployment currently stands at 3.4% in the greater San Antonio area. Residential real estate trends parallel growth and employment statistics with a median home price of $90,400 in 1999.

4.0 ALTERNATIVES

This section presents details of the alternatives considered in evaluating the HCP (Section 6.0). The Preferred Alternative, two alternate project designs, and the No Action Alternative are discussed in this EA/HCP. Expected environmental consequences of each of the four alternatives are presented in Section 5.0 of this document.

When we were assessing the impacts of the alternatives described below, we applied the same principles from the Endangered Karst Invertebrates Recovery Plan for Travis and Williamson counties, Texas (1994), since there is not a recovery plan for these species. Recovery criteria in this plan call for the preservation, in perpetuity, of three karst fauna areas (areas separated from each other both hydrologically and geologically), if three exist, for each species within each karst region. In reviewing the status of the affected species, we determined that three karst fauna areas of equal or greater ecological value to the species within the UTSA karst region will still exist after the proposed development. These are summarized below.

"Possibly" indicates a cave where a blind *Cicurina* species has been found, and based on the best available scientific information, this spider is most likely the federally listed endangered *C. madla*, but has yet to be confirmed.

Cave Name	*R. exilis*	*R. infernalis*	*C. madla*	Surrounding Conditions	Quality
Robbers Cave	Yes	Yes	Yes	centrally located within 147-acres of undeveloped land	High
Three Fingers Cave	Yes	Yes		centrally located within a large undeveloped tract	High
Hills & Dales Pit	Yes		Yes	within 74 acres to be preserved; approx. 130' from fenceline on one side; adjacent to the Robbers Cave tract	Medium*
Mastadon Pit	Yes			within approx. 300' of Loop 1604, contiguous with a large tract of undeveloped land	Medium
John Wagner Ranch Cave #3	Yes	Yes	Possibly	within 4 acre lot in developed, large-lot neighborhood, and contiguous with large tract of undeveloped land	Medium
La Cantera Cave #1	Yes		Possibly	adjacent to Loop 1604 but contiguous with large tract of undeveloped land	Medium
La Cantera Cave #2	Yes		Possibly	adjacent to Loop 1604 but contiguous with large tract of undeveloped land	Mediu m

* with potential to improve quality

A high quality cave has sufficient land area surrounding the cave to minimize negative edge effects and support cave cricket foraging and native flora and fauna communities, not only associated with a cave directly but also typical for that area. If most of these criteria exist for a cave, but there is an ongoing impact that cannot be remedied, a cave may be considered a medium quality cave. For example, all of the medium quality caves listed in the table above are contiguous with a large enough area to support native flora and fauna, but roads or other development are within a distance we believe impacts caves whether from contaminated runoff, removal of moisture through impervious cover, or increased edge effects.

4.1 Alternative 1 - Preferred Alternative

The Preferred Alternative includes two 1-acre on-site setbacks and five off-site preserves totaling 179 acres for mitigation of impacts to *Rhadine exilis* and *Cicurina madla* (Figure 5). The Applicant is proposing to seal La Cantera Cave #3 and place 1-acre setbacks around La Cantera caves #1 and #2. We do not believe 1 acre is sufficient for long-term viability for cave species; therefore, additional cave preserves are necessary to mitigate the impacts to La Cantera caves #1 and #2. The on-site measures to minimize impacts to the two listed species provide for 1-acre setbacks and a funded maintenance and monitoring plan for La Cantera caves #1 and #2. The purpose of the on-site monitoring will be specifically designed to evaluate the long-term impacts of small buffers on cave ecosystems. Off-site mitigation, in the form of acquisition of permanent karst preserves, not only provides for protection of *R. exilis* and *C. madla,* but also provides recovery opportunities for other listed invertebrates, including *Rhadine infernalis* and *Batrisodes venyivi,* as well as at least two new undescribed troglobitic spider species, a *Neoleptoneta* n.s. and a *Texella* n.s. The proposed mitigation caves also include the type localities of four of the nine Bexar County listed invertebrates (Table 1). Appendix I of the HCP provides a detailed description of each preserve (and caves within) that will be established to mitigate for impacts associated with the Preferred Alternative.

The Preferred Alternative includes the issuance of a permit under section 10(a)(1)(B) of the Act to authorize incidental take of *Rhadine exilis, R. infernalis,* and *Cicurina madla* during new construction and operation of mostly commercial development with potential for smaller amounts of residential, light industrial, and recreational features, with attendant roads and utilities on the Property.

Issuance of the permit will authorize construction and operation of commercial and residential development with attendant roads and utilities throughout the Property except as provided for in karst preserves and as described in the HCP.

Development plans for the Property have not been finalized, although development is expected to primarily be commercial with potential for smaller amounts of residential, light industrial, and recreational development. The proposed development will incorporate some open spaces and landscaped areas, but because final development configurations are unknown at this time, for the

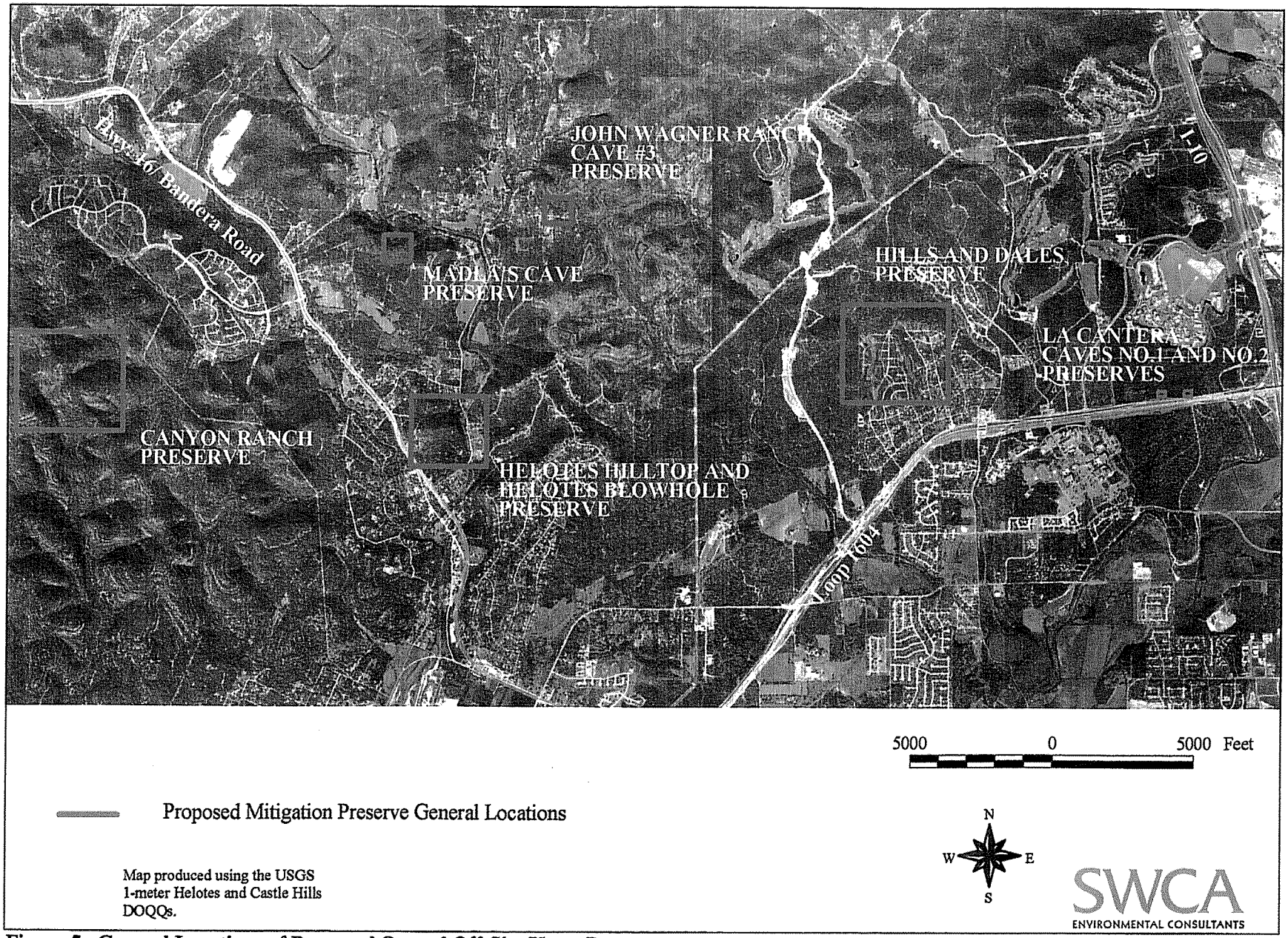


Figure 5. General Locations of Proposed On and Off-Site Karst Preserves.

purposes of this EA/HCP it is assumed that all portions of the Property exclusive only of the La Cantera Caves #1 and #2 1-acre setbacks, will be disturbed.

Water for the proposed development will be provided primarily by SAWS under regulation by the Edwards Aquifer Authority. Estimates provided by Pape-Dawson Engineers, Inc. indicate that upon completion and occupation of all proposed development, annual water usage would be equivalent to approximately 2,100 equivalent dwelling units or 756,000 gallons per day. Wastewater service would be provided by the City of San Antonio.

La Cantera Cave #3 lies in an area expected to contain a detention pond; this cave is expected to be partially filled with concrete and compacted clay prior to being covered by the pond. The filling of the upper portion of this cave will be done according to standards set forth by TNRCC under the Edwards Aquifer Rules. This development disturbance will substantially modify the surface area around and upper 10-15 feet of the cave.

The Preferred Alternative includes measures to minimize and mitigate for potential impacts to the federally endangered karst invertebrates known to occur on the Property. The major elements of the HCP for the Preferred Alternative include:

Outreach and Research Program: The Permittee will provide money to The Nature Conservancy of Texas towards outreach efforts with the goal of raising awareness, understanding, and appreciation for Bexar County endangered karst invertebrates. Outreach materials will be produced in consultation with and approved by the Service. A Texas Nature Conservancy professional will be involved that is familiar with different types of media and understands what information is effective for different groups, taking into account such things as age and type of landowner (for example, corporation or individual). The end goal is to increase understanding and appreciation for these species.

Secondly, the Permittee will provide to the Service, three times a year for three years, printouts of northern Bexar County multi-layered maps to include the following layers: karst fauna regions, karst zones, updated plats, and land use types.

Thirdly, the Permittee will fund genetics studies by Dr. Marshall Hedin, San Diego State University. These studies will be designed to provide techniques for definitive species level identification of immature specimens of eyeless *Cicurina* spiders in northern Bexar County.

On-site Preserves. One-acre on-site setbacks for La Cantera Caves #1 and #2 will be provided. Minimization measures include prohibiting uses that have a significant potential to contaminate sub-surface karst and/or groundwater on the eastern portion of the Property, such as gas stations, dry cleaners (on-site cleaning process), metal or chemical processing or manufacturing facilities, hazardous waste facilities, septic tanks, or any other uses prohibited by the TNRCC or the City of San Antonio.

The proposed karst preserves will be managed for the benefit of the listed karst invertebrates.

Management and monitoring responsibilities are also discussed in Section 6.0 of this EA/HCP. Public access to the preserves will be prohibited unless specifically authorized by Management (a Service authorized third-party entity [defined in Section 6.3 of this EA/HCP]) and the Service.

Off-site Preserves. For the Preferred Alternative, the Permittee will assure that five karst preserves totaling approximately 179 acres will be protected in perpetuity. These off-site preserves include: approximately 70 acres encompassing Hills and Dales Pit; approximately 75 acres on the Canyon Ranch Property that encompass Scenic Overlook, Canyon Ranch Pit, and Fat Man's Nightmare caves; an approximately 5-acre area encompassing Madla Cave; an approximately 4-acre area encompassing John Wagner Ranch Cave #3 (also called Menchaca Cave by the current owners); and approximately 25 acres encompassing Helotes Hilltop and Helotes Blowhole caves. A summary of endangered invertebrate species known from each of the proposed on- and off-site preserve caves is provided in Table 1. The proposed karst preserves will be managed for the benefit of the listed karst invertebrates. Management and monitoring responsibilities are also discussed in Section 6.0 of this EA/HCP. Public access to the preserves will be prohibited unless specifically authorized by Management and the Service.

The proposed approximately 70-acre Hills and Dales karst preserve lies in a low-density developing area, with residential development present to the east and southeast and undeveloped woodland present to the north, west, and southwest. This preserve is of sufficient size to maintain the karst ecosystem, however, the entrance of the cave is closer to the perimeter of the preserve than ideal.

The proposed approximately 75-acre Canyon Ranch karst preserve would be contiguous with the over 7,000-acre Government Canyon State Natural Area (GCSNA). GCSNA contains several caves located at the same stratigraphic level as the Canyon Ranch caves. The connection between the approximately 75-acre karst preserve and Government Canyon State Natural Area will contribute to protection for the entire karst ecosystem that includes Scenic Overlook Cave, Canyon Ranch Pit, and Fat Man's Nightmare.

Three of the off-site preserves (Madla, John Wagner Ranch, and Helotes Hilltop/Blowhole) are of insufficient size by themselves to provide a high probability for long-term conservation of the species. However, the size and shape of these preserves is based in part on the land surrounding the features that was practicably available for sale during preparation of the HCP (Robert Kuhn, sworn affidavit). These three preserve sites are the type localities for four of the nine listed karst invertebrates. Additionally, all three preserves are adjacent to or surrounded by undeveloped lands that are currently contributing to the long-term conservation of these sites. Therefore, the merits of these sites and the lack of availability for sale of additional lands around them, makes them of conservation benefit to this Preferred Alternative.

Total acreage for the Madla Cave preserve is approximately 5-acres. Vegetation in the area generally consists of Ashe juniper/live oak woodland. The proposed preserve encompasses the entire surface drainage area and approximately 80% of the potential subsurface drainage area as

Table 1. Summary of Endangered Species Known to Occur in Subject Caves. [* = type locality]

Preserve	Cave	Size in Acres	Endangered and Other Species Present	Basis of Identification	Karst Region
Property	LC Cave #1	1	*Rhadine exilis*	Kingsley, Grubbs (SWCA) 1994, 1995. Reddell, J.R. 1998, Troglobitic Ground Beetles of the Genus *Rhadine* from Bexar County, Texas. Reddell: 2000; sample codes 2002, 2004.	UTSA
			Cicurina sp. (eyeless)	Kingsley, Grubbs (SWCA): 1994, 1995. Cokendolpher: 2000; sample codes 2001, Cave 1.	
	LC Cave #2	1	*Rhadine exilis*	Kingsley, Grubbs (SWCA): 1994, 1995.	
			Cicurina sp. (eyeless)	Kingsley, Grubbs (SWCA): 1994, 1995	
Madla Cave	Madla Cave	5	*Cicurina madla** *Rhadine infernalis**	Texas Memorial Museum Speleological Monographs, 3 Studies on the Cave and Endogean Fauna of North America II, and The Caves of Bexar County, Second Edition, Reddell, J.R. 1998, Troglobitic Ground Beetles of the Genus *Rhadine* from Bexar County, Texas.	Helotes
John Wagner Ranch Cave #3	John Wagner Ranch Cave #3	4	*Rhadine exilis** *Rhadine infernalis* *Cicurina* sp. (eyeless) *Texella* sp. *Neoleptoneta* sp.	Texas Memorial Museum Speleological Monographs, 3 Studies on the Cave and Endogean Fauna of North America II, and The Caves of Bexar County, Second Edition, Reddell, J.R. 1998, Troglobitic Ground Beetles of the Genus *Rhadine* from Bexar County, Texas.	UTSA
Hills and Dales Pit	Hills and Dales Pit	70	*Rhadine exilis*	Reddell: 2000; sample code 5002.	UTSA
			Cicurina madla	Cokendolpher: 2000; sample code 5001.	
			Texella sp.	Reddell: 2000; no sample code. Cokendolpher: 2000; sample code 5001.	
			Neoleptoneta sp.	Cokendolpher: 2000; sample code 5001.	
Helotes Hilltop / Helotes Blowhole	Helotes Hilltop Cave	25	*Batrisodes venyivi**	Texas Memorial Museum Speleological Monographs, 3 Studies on the Cave and Endogean Fauna of North America II,	Helotes
			Rhadine exilis	SWCA (White, Bechtol) 2000.	
			Cicurina sp. (eyeless)	SWCA (Kingsley, Grubbs, White) 1999.	
	Helotes Blowhole Cave		*Rhadine exilis*	SWCA (Kingsley, Grubbs, White) 1999.	
			Rhadine infernalis	Reddell, J.R. 1998, Troglobitic Ground Beetles of the Genus *Rhadine* from Bexar County, Texas.	
			Cicurina madla.	Cokendolpher 2001: (unpublished text cites specimen collected by Grubbs, Kingsley, White of SWCA).	
Canyon Ranch	Scenic Overlook Cave	75	*Rhadine infernalis*	Reddell 2000: Sample code 2401.	Government Canyon
			Batrisodes venyivi	Reddell 2000: Sample code 2402.	
			Cicurina sp. (eyeless)	Cokendolpher 2000: Sample code 2101.	
			Texella sp.	Reddell 2000: Sample code 2404.	
	Fat Man's Nightmare Cave		*Rhadine infernalis*	Reddell 2000: Sample code 2301.	
			Cicurina sp. (eyeless)	SWCA (White) 2000.	
			Texella sp.	SWCA (White) 2000.	
	Canyon Ranch Pit		*Rhadine infernalis*	Sight Record, SWCA (White) 2000.	
			Cicurina sp. (eyeless)	SWCA (White) 2000.	

delineated by Veni and Associates (1994). The cave preserve is surrounded by undeveloped land. The 5-acre preserve will be conserved through a conservation easement. This cave is the type locality for *Rhadine infernalis* and *Cicurina madla.*

The proposed approximately 4-acre John Wagner Ranch Cave #3 preserve lies within a small residential neighborhood in the Grey Forest area of northwestern Bexar County. Land to the east, west, and south of the proposed preserve area contains low-density (1-5 acres) occupied residential lots. Land to the north consists of undeveloped scrubby ranch land and woodland. A relatively high diversity of troglobitic species coupled with presence of low-density residential areas immediately to the east, west, and south and a large tract of undeveloped land to the north made acquisition and management of the preserve area highly desirable. This cave is the type locality for *Rhadine exilis.*

The proposed approximately 25-acre karst preserve for Helotes Blowhole and Hilltop caves lies in a low-density developing area, with homes on large lots present nearby to the east, north, and south. The proposed preserve is situated primarily on the eastern slope of a large hill. The proposed preserve encompasses all the surface drainage area, and virtually all of the subsurface drainage area, of these two features (Pape-Dawson, Inc. 2000). Helotes Hilltop Cave is the type locality for *Batrisodes venyivi.*

Prior to any clearing or construction activities on the Property, the Permittee will acquire and dedicate the karst preserves for conservation and assure operation, maintenance and monitoring in perpetuity. Caves included in the mitigation proposal were chosen based on type and diversity of troglobitic species contained therein and availability of land in surrounding areas. A relatively high diversity of troglobitic species coupled with the presence of undeveloped land for relatively low-density residential areas near these properties made acquisition of these preserve areas highly desirable.

Preserve areas for Hills and Dales Pit and the three Canyon Ranch caves were designed and configured to incorporate the suite of biotic and abiotic factors needed to promote the integrity of fully functioning karst ecosystems on which the endangered invertebrates depend. Preserve designs were based on the result of a hydrogeologic investigation of Hills and Dales Pit performed by Pape-Dawson Engineers, Inc. (Pape-Dawson, Inc. 2000), hydrogeologic investigations of the Canyon Ranch caves performed by SWCA (SWCA 2000b), biota collections performed in these features by SWCA, and Service interpretation of scientific literature on habitat patch size, fragmentation, isolation, edge effects, corridors, and other factors considered to affect ecosystem stability. For the Hills and Dales and Canyon Ranch karst preserves, the following factors have been incorporated to the maximum extent possible:

- Zones of hydrogeologic influence determined by Pape-Dawson Engineers, Inc. (2000) and SWCA (2000b) to help protect the karst ecosystems from potential inflow of pollutants and adverse changes in the moisture regime;

- Optimum area needed to maintain viable, self-sustaining populations of cave

crickets, including setbacks of 500 feet as allowed by preserve land availability around each cave containing listed species within these preserves. Total size of each of these karst preserves should also help protect other invertebrates (such as daddy-longlegs), mammals, and herpetofauna that may provide nutrients to the caves, as well as help control fire ant infestations and protect native ant communities;

- Area needed to encourage continued presence of terrestrial vertebrates that provide nutrients to caves, such as raccoons, slimy salamanders (*Plethodon albagula*), cliff frogs (*Syrrhophus marnocki*), and various other species of vertebrates. A general rule of thumb for determining minimum preserve patch size is to encompass the largest home range size of the species inhabiting that patch (Harris 1984). For karst ecosystems, the raccoon has the largest home territory, ranging from 12-104 acres (Shirer and Fitch 1970; Rosatte et al. 1991). The Hills and Dales and Canyon Ranch preserves each meet this criteria. Additionally, as raccoons readily occur in suburban habitats such as could develop around the John Wagner Ranch Cave #3 and Helotes preserves, proposed boundaries of these preserves are not expected to limit occurrence of raccoons. Karst preserves such as proposed here that incorporate the area requirements for vertebrates will most likely also be large enough to maintain the surface invertebrate fauna; and,

- Minimal habitat fragmentation and isolation. Both Canyon Ranch and Hills and Dales contain large blocks of native vegetation. In addition, the caves in the approximately 75-acre Canyon Ranch preserve are at least 500 feet from the nearest preserve boundary. The cave in the approximately 70-acre Hills and Dales Pit preserve is at least 130 feet from the nearest preserve boundary and well over 500 feet inside the preserve in all other directions. The Canyon Ranch preserve is also adjacent to the Government Canyon State Natural Area, which contains a minimum of 3 caves containing endangered karst invertebrates and owned by Texas Parks and Wildlife Department, for an effective preserve size of over 7,000 acres. Large, contiguous preserves such as these minimize edge effects, habitat fragmentation, and isolation (Diamond 1975; May 1975; Wilcove et al. 1986; Kelly and Rotenberry 1993; Wigley and Roberts 1997; Kindvall 1999). Since roads may hinder movement of several species of invertebrates (Mader 1984; Mader et al. 1990) and small mammals, no new internal roads will occur within the karst preserves unless approved by the Service. Avoiding internal clearing activities and other disturbances of soil and native vegetation will help minimize fire ant infestations (Porter et al. 1988; Porter et al. 1991) and protect native ant communities (Porter et al. 1988; Porter et al. 1991; Suarez et al. 1998).

With the complexity of acquiring this many off-site preserves there is the possibility that one or more of the preserve acquisitions or conservation easements may not be fulfilled. If that occurs, then the Permittee with Service approval may substitute another preserve of equivalent species

value to meet the mitigation needs of this Preferred Alternative prior to any clearing or construction activities on the Property.

4.2 Alternative 2 - Reduced Development Alternative

Alternative 2 includes primarily commercial development similar to that described for Alternative 1 except that proposed development would be limited to approximately 100 acres less than in Alternative 1. Impacts beyond the existing condition to La Cantera Caves #1, #2, and #3 would be avoided by incorporating the three features into one 100-acre karst preserve (Figure 6), and no development would occur in that preserve. Alternative 2 does not include the issuance of a permit under Section 10(a)(1)(B) of the Endangered Species Act of 1973 to authorize incidental take of any of the listed species.

This development option was designed and analyzed by the Service with the assumption that non-preserve lands for Alternative 2 will be fully developed and no endangered species habitat value on those lands would remain. This development plan includes on-site measures to avoid impacts to federally endangered karst invertebrates known to occur on the Property.

Preservation of Karst Invertebrate Habitat. For Alternative 2, the Applicant would assure preservation and provide operation, maintenance, and monitoring in perpetuity of the 100-acre on-site preserve, including La Cantera Caves # 1, #2 and #3. The karst preserve would encompass all caves on the Property known to contain *Rhadine exilis* and *Cicurina madla* and would include a minimum 500-foot cricket foraging area and buffer for edge effects where such buffers may be provided given the existing roads. No existing roadways would be removed or realigned as that effort would be cost prohibitive.

The 100-acre karst preserve would encompass the entire surface and subsurface drainage area for La Cantera Caves #2 and 3, and the entire surface and majority of the subsurface drainage area for La Cantera Cave #1. Portions of the subsurface drainage for cave #1 extend under Loop 1604. The karst preserve was designed and configured with the same considerations used for the off-site preserves in Alternative 1.

Alternative 2 would not provide off-site mitigation for the endangered karst invertebrates; thus, the 179 off-site acres would not be established as karst invertebrate habitat preserves as under the Preferred Alternative and the off-site caves proposed to be protected under Alternative 1 would not receive active long-term management for the listed species. Alternative 2 would also provide greatly reduced economic value for the current Landowners by virtue of the loss of approximately 100 acres of otherwise developable land; therefore, the Applicant chose not to pursue this option.

Measures to Avoid Impacts to Karst Invertebrates. Measures include, but are not limited to, diversion of development runoff to areas outside of the karst preserve, restrictions on the use of pesticides and fertilizers, fire ant control, and prohibitions in the area outside the preserves of

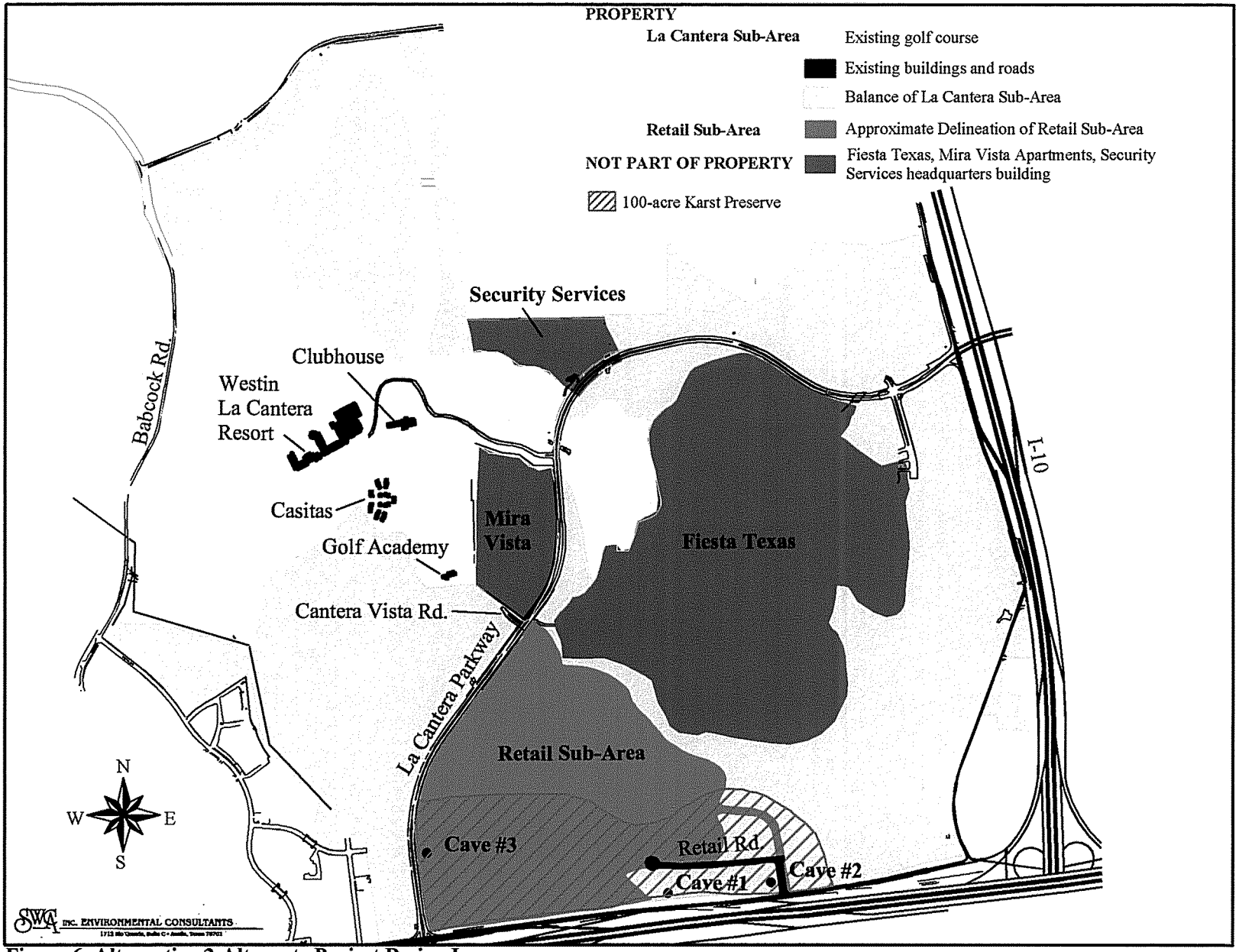


Figure 6. Alternative 2-Alternate Project Design I.

types of development such as chemical factories, gas stations, and dry cleaners that could pose a risk of contamination of the caves.

4.3 Alternative 3 - Greater Development Alternative

Alternative 3 includes primarily commercial development and off-site mitigation as described under the Preferred Alternative. However, under this alternative, one-acre karst preserves would not be established on-site around La Cantera Caves #1 and #2, with setbacks from these features limited to those acceptable to the TNRCC for recharge features located on the Edwards Aquifer Recharge Zone. Such setbacks would be approximately 100 feet up-gradient and 50 feet down-gradient of the cave entrances and encompass about 0.5 acres around each cave. La Cantera Cave #3 would be sealed (top 10-15 feet of a 70 ft. cave) and covered by a detention pond as described under Alternative 1.

This development option was analyzed by the Service with the assumption that no endangered species habitat value would remain anywhere on the Property following development. However, additional mitigation off-site would be required; therefore, the Applicant chose not to pursue this option.

4.4 Alternative 4 - No Action

This alternative assumes that the proposed development does not occur and that no application for an incidental take permit is processed. Choosing this alternative would not result in take of endangered species, nor would any development occur. In addition, the 179 acres proposed as off-site mitigation under Alternative 1 would not become part of a karst preserve system in perpetuity and there would be no active long-term management on- and off-site for listed species. No type of monitoring or management would be done as proposed in the HCP, and lands surrounding all on- and off-site caves would be subject to unauthorized all-terrain vehicle, mountain bike, and dumping use, as well as be vulnerable to vandalism. Fire ants would also be likely to become more of a threat without active management. This alternative would also provide no economic value for the current Landowners; therefore, the Applicant chose not to pursue this option.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 Alternative 1 - Preferred Alternative

5.1.1 On-site Impacts

5.1.1.1 Vegetation

It is anticipated that final development plans will incorporate some undisturbed open spaces and landscaped areas, but because location of any such vegetated areas is unknown at this time, for the purposes of this evaluation it is assumed that vegetation throughout the proposed

development area will be disturbed. Development would chiefly occur on upland areas where vegetation consists primarily of woodlands composed of Ashe juniper and live oak. Natural vegetation in development areas would be removed and replaced with structures, impervious cover, and landscape plants, which would consist of native vegetation to the greatest extent practicable. As much as possible, existing native vegetation would be maintained in development areas.

5.1.1.2 Wildlife

Wildlife within those areas planned for development would largely be displaced to adjacent areas during the construction process. Following construction, landscape vegetation and preserved trees would provide habitat for those species tolerant of suburban and urban development. Direct and indirect effects of development may result in negative or positive impacts to the populations of some wildlife species. Populations of white-winged dove (*Zenaida asiatica*), western kingbird (*Tyrannus verticalis*), European starling (*Sturnis vulgaris*), great-tailed grackle (*Quiscalus mexicanus*), and roof rat (*Rattus rattus*) are likely to increase because of increases in availability of food for them near proposed development areas and their preference for or tolerance of developed areas.

5.1.1.3 Listed, Proposed, and Candidate Species

Two listed species, *Rhadine exilis* and *Cicurina madla*, are known to occur on the Property. Both of the species are present in La Cantera Cave #1 and La Cantera Cave #2; *Cicurina madla* is also present in La Cantera Cave #3. None of the other seven listed species of Bexar County karst invertebrates is known from the Property, nor is there expected to be any impacts to these seven species.

The Service has examined the concern that the combined current level of water withdrawal for all consumers from the Edwards Aquifer could adversely affects aquifer-dependent species located at Comal and San Marcos Springs during low flows and that effects on aquifer-dependent springflows could affect Cagle's map turtle (a candidate for listing), other regional efforts apart from this EA/HCP are expected to address the potential impacts to aquifer-dependent species from water withdrawals. The Edwards Aquifer Authority (Authority; EAA) is a political subdivision of the State of Texas and is charged with the duty to manage, conserve, preserve and protect the Edwards Aquifer. The Authority has retained a qualified consultant to assist with the development of a regional Habitat Conservation Plan for the protection of all federally listed endangered or threatened species in the Edwards Aquifer and at Comal and San Marcos Springs. While development of the Property is expected to purchase water from the San Antonio Water System (SAWS), SAWS operates under the regulation of the Authority. Thus, any impacts associated with the Property increasing withdrawal of water from the Edwards Aquifer will be avoided, minimized, and/or mitigated by other federally approved actions. Threats to these species can be effectively addressed best on a regional, collective basis and SAWS and the EAA are the two entities primarily responsible for implementing a regional conservation effort.

The Preferred Alternative would provide for the protection of one acre each around caves #1 and #2, while Cave #3 would be sealed and covered with a detention pond. Other karst features not included in the proposed karst preserves, and not including listed species, or their habitat, lie in areas that would be developed subject to TNRCC regulations (Edwards Aquifer Rules) for protection of water quality within the Edwards Aquifer Recharge Zone.

As part of the proposed action, an HCP has been developed by the Applicant to avoid, minimize, and mitigate for the potential adverse impact to the two endangered karst invertebrate species and their habitat known on the Property and assure that this action does not appreciably reduce the potential for survival and recovery of the listed karst invertebrates as mandated by requirements of 50 CFR Part 17.22(b)(1)(iii). The HCP is detailed in Section 6.0 of this EA/HCP.

Assessment of Take

La Cantera Cave #3 will be closed (sealed) and totally impacted and La Cantera caves #1and #2 will remain open with development setbacks of one-acre each. Therefore, take of *Rhadine exilis* will occur in Caves #1 and #2, and take of *Cicurina madla* will occur in all three caves during the construction and occupation of the Property associated with the Preferred Alternative. Although no endangered karst invertebrates are known to occur in areas proposed for development outside of the three La Cantera Caves, potential exists for listed species to be present in subsurface void spaces lacking obvious surface expression that could be destroyed or significantly disturbed by construction activities. Since all portions of the Property outside of the two proposed on-site karst preserves are expected to be developed, any endangered karst invertebrates occurring in these areas are expected to be taken by completion of the Preferred Alternative. Due to the extensive karst surveys of the Property, the likelihood of discovering previously undetected habitat is considered low.

Rhadine infernalis is known from the UTSA karst region, and any take of this species in the three caves on the property has been adequately mitigated for within the proposed preserves; therefore, the Applicant will be covered for take of this species that may occur due to development on the Property. In the event the species is taken during construction and occupation of the Property, three karst fauna areas of equal or greater ecological value to the species within the UTSA karst region will still exist after the proposed development.

5.1.1.4 Jurisdictional Wetlands

No jurisdictional wetland areas are located on the Property.

5.1.1.5 Geologic Features and Soils

Areas proposed for the karst preserve and commercial and residential development are underlain by the Edwards Group. Since soils are very thin and rocky, surface soil alterations in development areas, such as those resulting from grading, will be minimal and will comply with all applicable Bexar County construction codes for erosion and sedimentation control during the

construction process. Construction is likely to require drilling or excavation of limestone bedrock in order to install foundations and utility lines.

5.1.1.6 Land Use

New development on the Property will consist of commercial and, possibly, residential or light industrial development. The proposed action is comparable and compatible with current land use in the area. The UTSA campus is located across Loop 1604 to the south of the Property, the Fiesta Texas Six Flags theme park is present in a former quarry surrounded by the Property, commercial developments are present along Loop 1604 and I-10 adjacent to the Property, and residential developments are present to the west and north.

5.1.1.7 Water Resources

Most of the water for the proposed development will be provided by SAWS. Other sources of water are the existing Trinity Aquifer wells and irrigation ponds on-site. Annual water demand for the completed development is expected to be approximately 2,100 equivalent dwelling units or 756,000 gallons per day. Currently, SAWS obtains the majority of its water from the Edwards Aquifer; however, the City of San Antonio is actively exploring alternate sources for water, including construction of reservoirs on the Colorado River downstream of the City of Columbus in Colorado County, Texas. Ultimately, SAWS is likely to provide its customers with water that originates from the Edwards Aquifer as well as alternate sources such that future source of water for the Preferred Alternative cannot be positively identified at this time. The Preferred Alternative will increase the demand for water in the project area.

5.1.1.8 Air Quality

Development of the Property will increase exhaust emissions somewhat by increasing the number of gas-powered vehicles on the Property. A reduction in the number of trees on the Property may slightly reduce air filtering capabilities. A temporary increase in dust levels is expected during the construction process.

5.1.1.9 Water Quality

Although the Preferred Alternative will comply with all applicable environmental regulations, it is expected that some level of water quality degradation will result from the proposed development even though water quality mitigation would be designed in accordance with a TNRCC Water Pollution Abatement Plan (WPAP). At the levels of impervious cover proposed and the level of water quality treatment required, a portion of stormwater from most rainfall events will not be captured and treated. The Edwards Rules require capture of 80% of the development-induced loading of Total Suspended Solids (TSS). Therefore, up to 20% of the development-induced loading of TSS will be discharged from proposed development. In addition, changes in the volume and timing of runoff due to impervious cover, will result in changes to the hydrograph. These changes could result in increased streambank erosion and

impacts to downstream resources.

Currently only the Retail Sub-area (Figure 2) has completed a WPAP (March, 2001). The pollution abatement measures provided for this portion of the Property include five (5) sand filter basins. These basins will capture a total of 3,837,836 gallons of stormwater runoff from the development, and filter it through an 18-inch sand media before releasing it to drain to Leon Creek. The basins have been designed in accordance with TNRCC's Technical Guidance Manual. Energy dissipaters will be provided at all points of concentrated stormwater discharge where excessive velocities are anticipated. This will help reduce the potential for erosion. Best Management Practices will include daily monitoring for trash and litter accumulation, collection and disposal.

In addition to the water quality measures required by the TNRCC, 148 acres of off-site mitigation lands (Canyon Ranch and Hills and Dales preserves) are located on the recharge zone and will contribute to water quality protection over the recharge zone.

5.1.1.10 Cultural Resources

No significant cultural resources are known to occur on the Property. No historic structures occur on the Property. Because soils are generally very thin and the Property is primarily upland in nature, potential for occurrence of significant intact prehistoric sites is considered to be low.

5.1.1.11 Socioeconomic Environment

The proposed development, construction, and occupation of the Property would result in construction and operation of commercial and other development with attendant roads and utilities on almost all portions of the Property. Proposed land uses may vary depending upon market conditions at the time of development. However, it is expected that development of this Property would provide additional commercial and, possibly, residential areas.

5.1.2 Off-site Impacts

No off-site construction is required for completion of the Preferred Alternative.

5.1.2.1 Vegetation

No off-site impacts to vegetation are expected on adjacent properties as a result of completion of the Preferred Alternative since these properties are largely developed. Mitigation proposed as part of the Preferred Alternative would provide greater protection of plant communities contained in the 181 acres of on- and off-site karst preserves.

5.1.2.2 Wildlife

Wildlife within those areas planned for development would largely be displaced into adjacent

areas during the construction process. Those species dependent on the existing habitat proposed for development will likely decrease in the local area. Following construction, landscape vegetation and preserved trees would provide habitat for those species tolerant of suburban and urban development, resulting in increased populations in the surrounding area. Direct and indirect effects of development may result in negative or positive impacts to the populations of some species in the area. For example, snakes and other native herpetofaunal species may decrease due to decreased habitat availability and human presence. Populations of European starling and great-tailed grackle may increase due to potential increases in availability of food for them in proposed development areas and their greater tolerance for human disturbance.

The Preferred Alternative would provide greater benefits to wildlife communities in the off-site karst preserves. Fire ant control would be performed in all preserves, which will benefit populations of surface and subterranean species of invertebrates, as well as many species of smaller vertebrates that feed on invertebrates or are preyed upon by fire ants. Wildlife habitat within the approximately 75-acre Canyon Ranch karst preserve several miles west of the Property (Figure 5) would be connected directly to the over 7,000-acre Government Canyon State Natural Area in the northwestern section of Bexar County, which would help promote stable wildlife communities within the proposed preserve.

5.1.2.3 Listed, Proposed, and Candidate Species

No adverse impacts are expected to occur to off-site listed endangered karst invertebrates. Proposed off-site preserves will contribute to the conservation of four of the nine endangered karst invertebrates listed in Bexar County, including *Rhadine exilis*, *Rhadine infernalis*, *Cicurina madla,* and *Batrisodes venyivi.* Proposed off-site preserves will also contribute to the conservation of some undescribed species including *Texella* new species and *Neoleptoneta* new species, as well as a host of more common, as well as rare, non-listed cave fauna.

5.1.2.4 Jurisdictional Wetlands

No off-site impacts to jurisdictional wetlands are expected.

5.1.2.5 Geologic Features and Soils

No off-site impacts to geologic features or soils are expected as a result of completion of activities within those areas planned for development.

5.1.2.6 Land Use

The Preferred Alternative may result in an increase in supportive businesses such as stores and restaurants. These businesses are fully compatible and comparable to current human land use in the area and will be subject to separate environmental review and approvals.

5.1.2.7 Water Resources

Proposed development will result in use of water originating off-site as provided by SAWS in addition to some pre-existing water resources on-site. SAWS is responsible for ensuring that its acquisition and provision of water does not adversely affect water resources.

5.1.2.8 Air Quality

Development of the Property is expected to result in an increase in the number of motorized vehicles in the area, which may result in a slight decrease in air quality. A reduction in the number of trees on the Property may slightly reduce local air filtering capabilities. A temporary increase in dust levels is expected during the construction process.

5.1.2.9 Water Quality

Although the Preferred Alternative will comply with all applicable environmental regulations, it is expected that some level of water quality degradation will result from the proposed development. At the levels of impervious cover proposed and the level of water quality treatment required, a portion of stormwater from most rainfall events will not be captured and treated. The Edwards Rules require capture of 80% of the development-induced loading of Total Suspended Solids (TSS). Therefore, up to 20% of the development-induced loading of TSS will be discharged from proposed development. In addition, changes in the volume and timing of runoff due to impervious cover, will result in changes to the hydrograph. These changes could result in increased streambank erosion and impacts to downstream resources. However, 148 acres of off-site mitigation lands (Canyon Ranch and Hills and Dales preserves) are located on the recharge zone and will contribute to the water quality protection over the recharge zone.

5.1.2.10 Cultural Resources

No off-site impacts to cultural resources are expected.

5.1.2.11 Socioeconomic Environment

The Preferred Alternative will result in an increase in jobs in the area. This alternative may also result in an increase in supportive businesses such as stores and restaurants. There may be an increase in the need for road repairs and other public services in the area, along with an increased tax base.

5.1.3 Cumulative Impacts

This section considers the past, present, and future projects, authorized or under review, that are considered to contribute to the cumulative impacts on not only endangered, threatened, and other rare species, but also on society and the human environment in the greater San Antonio area.

5.1.3.1 Vegetation

Because the Preferred Alternative would result in disturbance of vegetation, primarily Ashe juniper/live oak woodlands, it would cumulatively contribute to the loss of this vegetation type in Bexar County. Protection of 179 acres of native vegetation in the five off-site karst preserves will contribute to the perpetual protection of the native plant communities in the area.

5.1.3.2 Wildlife

The Preferred Alternative would contribute to a cumulative reduction of habitat for some wildlife species intolerant of human disturbance or presence when added to impacts resulting from other development, road construction, and other types of land use projects in Bexar County. Wildlife species associated with urban and suburban settings would likely increase, while species intolerant of development would locally decrease. However, protecting the native plant and animal communities on the karst preserves will contribute to the perpetual protection of native wildlife populations off the Property.

5.1.3.3 Listed, Proposed, and Candidate Species

The existing quality of endangered species habitat presently provided by the three La Cantera caves is not optimal. Yet, the Preferred Alternative would significantly reduce the amount of endangered karst invertebrate habitat present in the project region. This would contribute to the total reduction of *R. exilis* and *C. madla* and their habitat in the region.

Because the Preferred Alternative would protect approximately 2 acres on-site and 179 acres off-site in perpetuity, the project is expected to provide conservation benefits to the Bexar County endangered karst invertebrates.

5.1.3.4 Jurisdictional Wetlands

No jurisdictional wetland areas are known to occur on the Property, nor will any be affected off-site. Thus there are no cumulative impacts to jurisdictional wetlands.

5.1.3.5 Geologic Features and Soils

Cumulative impacts to geologic features and soils as a result of the Preferred Alternative are expected to be minor.

5.1.3.6 Land Use

The Preferred Alternative would contribute to the cumulative conversion of undeveloped land to developed land in the San Antonio area. However, the Preferred Alternative would preserve 2 acres of undeveloped land on-site and 179 acres of undeveloped land off-site in perpetuity.

5.1.3.7 Water Resources

Together with other development occurring in the area, the Preferred Alternative will add to overall demand for water resources. Additionally, the Authority and SAWS will have an increased burden to provide water to the region (both in the aquifer region and downstream) without jeopardizing the endangered Edwards Aquifer-dependent species.

5.1.3.8 Air Quality

The Preferred Alternative will contribute to degradation of air quality in the San Antonio area primarily through an increase in automobile emissions. The degree of impact will depend upon air quality requirements for construction activities and automobiles. Continued development of the area will likely result in impacts on air quality at some time in the future.

5.1.3.9 Water Quality

The increase in runoff and infiltration containing pollutants and pesticides will add to that produced by other existing or planned development in the area, resulting in reduction in water quality in the Leon Creek watershed and Edwards Aquifer over time. However, the 148 acres of off-site mitigation lands (Canyon Ranch and Hills and Dales preserves) are located on the recharge zone and will contribute to the overall reduction in development over the recharge zone.

5.1.3.10 Cultural Resources

Cumulative impacts to cultural resources as a result of the Preferred Alternative are expected to be minor.

5.1.3.11 Socioeconomic Environment

The Preferred Alternative will contribute to the increase in population and traffic in northern Bexar County, which will, over time, become more urbanized as new development occurs.

5.2 Alternative 2 - Reduced Development Alternative

5.2.1 On-site Impacts

5.2.1.1 Vegetation

Approximately 100 fewer acres of land are proposed for development under Alternative 2. Development would chiefly occur in upland areas where vegetation consists primarily of Ashe juniper/live oak woodland. Natural vegetation in development areas would be removed and replaced with structures, impervious cover, and landscape plants, which would consist of native vegetation to the greatest extent practicable. As much as possible, existing native vegetation would be maintained in the development areas.

5.2.1.2 Wildlife

Impacts to wildlife would be similar to those described in the Preferred Alternative, although preservation of 100 acres of native vegetation in the on-site karst preserve could allow some animal species less tolerant of human disturbance (that might not occur on the Property following completion of the Preferred Alternative) to occupy the Property following development under Alternative 2. Wildlife within those areas planned for development would largely be displaced to adjacent areas during the construction process. Following construction, landscape vegetation and preserved trees would provide habitat for those species tolerant of urban and suburban development.

5.2.1.3 Listed, Proposed, and Candidate Species

No adverse impacts are expected to occur to listed endangered karst invertebrates. Known populations of *Rhadine exilis* and *Cicurina madla* on the Property would not be disturbed (beyond existing disturbances) under this alternative. The 100-acre karst preserve would encompass approximately 142 of the 404 karst features known on the Property. Preservation of these features, and any trogloxene species they contain, could contribute to the health of karst ecosystems within La Cantera Caves #1, #2, and #3.

Assessment of Take

None of the karst features occurring on the Property outside the 100-acre preserve are known to contain listed invertebrates. Disturbance of karst invertebrate habitat in La Cantera Caves #1, #2, and #3 during construction in development areas is not expected, therefore, no take is anticipated. However, take of endangered karst invertebrates could occur during construction activities in the development areas, since the potential exists to disturb voids that lack obvious surface expression containing the listed species. Size of the karst preserve is expected to minimize potential for deleterious edge effects or an increase in intensity of fire ant infestations.

5.2.1.4 Jurisdictional Wetlands

No jurisdictional wetland areas are located on the Property.

5.2.1.5 Geologic Features and Soils

Impacts to geologic features and soils would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.1.6 Land Use

Impacts to land use would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.1.7 Water Resources

Impacts to water resources would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.1.8 Air Quality

Impacts to air quality would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.1.9 Water Quality

Impacts to water quality would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.1.10 Cultural Resources

Impacts to cultural resources would be similar to those described for the Preferred Alternative.

5.2.1.11 Socioeconomic Environment

Impacts to the socioeconomic environment would be similar to those described for the Preferred Alternative.

5.2.2 Off-site Impacts

No off-site construction is required for completion of Alternative 2.

5.2.2.1 Vegetation

Off-site impacts to vegetation would be similar to those described for the Preferred Alternative.

5.2.2.2 Wildlife

Wildlife within those areas planned for development would largely be displaced to adjacent areas during the construction process. Because less land would be developed under this alternative than under the Preferred Alternative, fewer species would be displaced and some of the otherwise displaced wildlife may remain on-site within the 100-acre karst preserve. Populations of those species dependent on the existing habitat proposed for development will likely decrease in the local area. Following construction, landscape vegetation and preserved trees would provide habitat for those species tolerant of urban and suburban development, resulting in increased populations in the surrounding area.

5.2.2.3 Listed, Proposed, and Candidate Species

Off-site impacts to listed, proposed, and candidate species would be similar to those described for the Preferred Alternative, although no off-site preserves would be aquired.

5.2.2.4 Jurisdictional Wetlands

Off-site impacts to jurisdictional wetlands would be similar to those described for the Preferred Alternative.

5.2.2.5 Geologic Features and Soils

Off-site impacts to geologic features and soils would be similar to those described for the Preferred Alternative.

5.2.2.6 Land Use

Off-site impacts to land use would be similar to those described for the Preferred Alternative.

5.2.2.7 Water Resources

Off-site impacts to water resources would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.2.8 Air Quality

Off-site impacts to air quality would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.2.9 Water Quality

Off-site impacts to water quality would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.2.10 Cultural Resources

Off-site impacts to cultural resources would be similar to those described for the Preferred Alternative.

5.2.2.11 Socioeconomic Environment

Off-site impacts to socioeconomic environment would be similar to those described for the Preferred Alternative.

5.2.3 Cumulative Impacts

5.2.3.1 Vegetation

Because Alternative 2 would result in disturbance of vegetation, primarily Ashe juniper/live oak woodlands, it would cumulatively contribute to the loss of this vegetation type in Bexar County. Protecting the 100 acres of upland vegetation in the karst preserve would contribute to the perpetual protection of native plant communities in the area.

5.2.3.2 Wildlife

Alternative 2 would contribute to a cumulative reduction of habitat for some wildlife species intolerant of human impacts when added to impacts resulting from other development, road construction, and other types of land use projects in Bexar County. Wildlife species associated with urban and suburban settings would likely increase, while species intolerant of development would locally decrease. Protecting the native plant and animal communities in the karst preserve would contribute to the perpetual protection of wildlife populations both on and off the Property.

5.2.3.3 Listed, Proposed, and Candidate Species

Since Alternative 2 was developed to avoid impacts to karst species, there will likely be minimal cumulative impacts to the listed karst invertebrates. The design and configuration of the karst preserve is based on the best scientific information available. Cumulative impacts to Edwards Aquifer-dependent species would be similar to the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.3.4 Jurisdictional Wetlands

Cumulative impacts to jurisdictional wetlands would be similar to those described for the Preferred Alternative.

5.2.3.5 Geologic Features and Soils

Cumulative impacts to geologic features and soils would be similar to those described for the Preferred Alternative.

5.2.3.6 Land Use

Cumulative impacts to land use would be similar to those described for the Preferred Alternative. However this alternative would preserve 100 acres of undeveloped land on-site and no off-site lands.

5.2.3.7 Water Resources

Cumulative impacts to water resources would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.3.8 Air Quality

Cumulative impacts to air quality would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.3.9 Water Quality

Cumulative impacts to water quality would be similar to those described for the Preferred Alternative, although they would be slightly less due to the reduction in development.

5.2.3.10 Cultural Resources

Cumulative impacts to cultural resources would be similar to those described for the Preferred Alternative.

5.2.3.11 Socioeconomic Environment

Cumulative impacts to socioeconomic environment would be similar to those described for the Preferred Alternative.

5.3 Alternative 3 - Greater Development Alternative

5.3.1 On-site Impacts

5.3.1.1 Vegetation

Impacts to vegetation would be similar to those described for the Preferred Alternative.

5.3.1.2 Wildlife

Impacts to wildlife would be similar to those described for the Preferred Alternative.

5.3.1.3 Listed, Proposed, and Candidate Species

Impacts to listed karst invertebrate species would be larger than those described for the Preferred Alternative, and additional mitigation would be required.

Assessment of Take

Decrease in size of the areas preserved around La Cantera Caves #1 and #2 would increase the probability of disturbance of invertebrate habitat by adjacent construction activities and decrease the ability of these preserves to support the karst invertebrate ecosystems. Site clearing, construction, and development activities within 100 feet of the cave entrances could greatly increase the intensity of fire ant infestations within the karst preserves and/or introduce other exotic species that could be detrimental to the karst ecosystems. Development under this alternative increases the probability of loss of *Rhadine exilis* and *Cicurina madla* from La Cantera Caves #1 and #2. In addition, take of endangered karst invertebrates could occur during construction activities in the development area, since the potential exists to hit voids containing the listed species and do damage before construction ceases. La Cantera Cave #3 would be taken as described in the Preferred Alternative and would result in the take of *C. madla*.

5.3.1.4 Jurisdictional Wetlands

No jurisdictional wetland areas are known to occur on the Property.

5.3.1.5 Geologic Features and Soils

Impacts to geologic features and soils would be similar to those described for the Preferred Alternative.

5.3.1.6 Land Use

Impacts to land use would be similar to those described for the Preferred Alternative.

5.3.1.7 Water Resources

Impacts to water resources would be similar to those described for the Preferred Alternative.

5.3.1.8 Air Quality

Impacts to air quality would be similar to those described for the Preferred Alternative.

5.3.1.9 Water Quality

Impacts to water quality would be similar to, but slightly greater than, those described for the Preferred Alternative.

5.3.1.10 Cultural Resources

Impacts to cultural resources would be similar to those described for the Preferred Alternative.

5.3.1.11 Socioeconomic Environment

Impacts to socioeconomic resources would be similar to those described for the Preferred Alternative.

5.3.2 Off-site Impacts

No off-site construction is required for completion of Alternative 3.

5.3.2.1 Vegetation

Off-site impacts to vegetation would be similar to those described for the Preferred Alternative.

5.3.2.2 Wildlife

Off-site impacts to wildlife would be similar to those described for the Preferred Alternative.

5.3.2.3 Listed, Proposed, and Candidate Species

Off-site impacts to listed endangered species would be similar to those described for the Preferred Alternative.

5.3.2.4 Jurisdictional Wetlands

Off-site impacts to jurisdictional wetlands would be similar to those described for the Preferred Alternative.

5.3.2.5 Geologic Features and Soils

Off-site impacts to geologic features and soils would be similar to those described for the Preferred Alternative.

5.3.2.6 Land Use

Off-site impacts to land use would be similar to those described for the Preferred Alternative.

5.3.2.7 Water Resources

Off-site impacts to water resources would be similar to those described for the Preferred Alternative.

5.3.2.8 Air Quality

Off-site impacts to air quality would be similar to those described for the Preferred Alternative.

5.3.2.9 Water Quality

Off-site impacts to water quality would be similar to, but slightly greater than, those described for the Preferred Alternative.

5.3.2.10 Cultural Resources

Off-site impacts to cultural resources would be similar to those described for the Preferred Alternative

5.3.2.11 Socioeconomic Environment

Off-site impacts to the socioeconomic environment would be similar to those described for the Preferred Alternative.

5.3.3 Cumulative Impacts

5.3.3.1 Vegetation

Cumulative impacts to vegetation would be similar to those described for the Preferred Alternative.

5.3.3.2 Wildlife

Cumulative impacts to wildlife would be similar to those described for the Preferred Alternative.

5.3.3.3 Listed, Proposed, and Candidate Species

Cumulative impacts to listed endangered species would be greater than those described for the Preferred Alternative because the areas around La Cantera caves #1 and #2 would be much smaller thereby reducing the possibilities even further for long-term survival.

5.3.3.4 Jurisdictional Wetlands

Cumulative impacts to jurisdictional wetlands would be similar to those described for the Preferred Alternative.

5.3.3.5 Geologic Features and Soils

Cumulative impacts to geologic features and soils would be similar to those described for the Preferred Alternative.

5.3.3.6 Land Use

Cumulative impacts to land use would be similar to those described for the Preferred Alternative.

5.3.3.7 Water Resources

Cumulative impacts to water resources would be similar to those described for the Preferred Alternative.

5.3.3.8 Air Quality

Cumulative impacts to air quality would be similar to those described for the Preferred Alternative.

5.3.3.9 Water Quality

Cumulative impacts to water quality would be similar to, but slightly greater than, those described for the Preferred Alternative.

5.3.3.10 Cultural Resources

Cumulative impacts to cultural resources would be similar to those described for the Preferred Alternative.

5.3.3.11 Socioeconomic Environment

Cumulative impacts to the socioeconomic environment would be similar to those described for the Preferred Alternative.

5.4 Alternative 4 - No Action

Under this alternative, the Applicant would not develop the Property and no impacts to or take of karst invertebrates would occur. However, abandonment of the Preferred Alternative would result in the loss of significant monies invested by the Applicant in the Property and would be economically impractical for them. Moreover, the Property would have no active management for endangered species and no provision of land or money would go toward the long-term conservation of karst invertebrates in Bexar County.

6.0 HABITAT CONSERVATION PLAN

This section contains the specific conservation plan for the Preferred Alternative. In addition to proposed off-site mitigation lands, the Preferred Alternative consists of mostly commercial development with potential for smaller amounts of residential, light industrial, and recreational features, with attendant roads and utilities on the undeveloped portions of the Property (Figure 2), outside the 1-acre setbacks around La Cantera caves #1 and #2.

This Habitat Conservation Plan (HCP) is provided to minimize and mitigate any potential impacts on the "Covered Species" occurring as a result of new development on the Property. This HCP also describes preserves for La Cantera Caves #1 and #2 with attendant prudent development safeguards and the acquisition and protection of 179 acres of off-site karst preserves. The Applicant has also committed to assist with the outreach and research program as described in Section 6.1 below.

There are no additional conservation measures or surveys beyond those specifically stated in this HCP or previously accomplished that will be implemented on the property with respect to detecting or addressing currently unknown karst features subsurface voids or caves. Based upon extensive karst surveys performed to date, it is considered unlikely, that previously undetected karst invertebrate habitat will be encountered. As mandated by requirements of 50 CFR Part 17.22(b)(l)(iii), the HCP is intended to ensure that development of the Property will not reasonably be expected to appreciably reduce the likelihood of the survival and recovery of any listed species. The off-site mitigation provided by the HCP enhances conservation for the Covered Species and provides conservation for a host of other cave fauna.

In addition, the USAA Foundation has previously contributed $100,000 to the acquisition of an additional 700 acres of the Government Canyon State Natural Area, an acquisition specifically intended to enhance conservation opportunities for Bexar County karst invertebrates and Edwards Aquifer water quality. Pursuant to 50 CFR Section 402.14(g)(8), the Service is directed, when formulating its biological opinion, any reasonable and prudent alternatives, and any reasonable and prudent measures, to give appropriate consideration to any beneficial actions taken by the Applicant, including any actions taken prior to the initiation of consultation.

The proposed preserve system and other measures proposed to minimize impacts to known localities of the listed karst species are based on geologic, biologic, and hydrogeologic studies, as well as other studies conducted within Bexar County, Texas, and, in addition, an extensive literature review.

Based on discussions with and suggestions from the Service, the Applicant proposes that the permit issued in connection with this HCP will establish a process for the issuance of "Certificates of Inclusion" to purchasers of portions of the Property upon such purchasers signing "Agreements of Inclusion." This procedure is to allow an efficient mechanism to assign the benefits of the permit and to ensure the implementation of this HCP. These procedures are detailed in the Implementing Agreement.

Goals

The goals of this HCP are:

(1) to minimize and mitigate for the potential negative effects of constructing and operating commercial, light industrial, recreational, and residential development near and adjacent to, currently occupied endangered karst invertebrate habitat;

(2) to contribute to conservation of the Covered Species and other listed and non-listed cave or karst fauna.

6.1 Outreach and Research Program

The Permittee will provide $20,000 to The Nature Conservancy of Texas (or other entity approved by the Service) toward outreach efforts with the goal of raising awareness, understanding, and appreciation for Bexar County endangered karst invertebrates. Outreach materials will be produced in consultation with and approved by the Service. A Texas Nature Conservancy professional will be involved that is familiar with different types of media and understands what information is effective for different groups, taking into account such things as age and type of landowner (for example, corporation or individual). The end goal is to increase understanding and appreciation for these species. The Nature Conservancy will be required to agree that the materials will be completed within one year of permit issuance.

The Permittee will also contribute to further research in aid of karst fauna conservation, as follows:

- Three times a year, for three years from permit issuance, the Permittee will provide to the Service printouts of northern Bexar County multi-layered maps to include the following layers: karst fauna regions, karst zones, updated plats, and land use types. The Permittee will not be responsible for generating, or for the accuracy of, the data upon which the maps will be based.

- The Permittee will fund genetics studies by Dr. Marshall Hedin, San Diego State University in an amount of $15,000. These studies will be designed to provide techniques for definitive species level identification of immature specimens of eyeless *Cicurina* spiders in northern Bexar County.

6.2 Preserve System

The Applicant will cause seven karst preserves totaling 181 acres to be protected in perpetuity. The karst preserves include two 1-acre on-site preserves, one for each of La Cantera Caves #1 and #2, and five off-site preserves totaling approximately 179 acres. Off-site preserves include: an approximately 5-acre area encompassing Madla Cave; an approximately 4-acre area encompassing John Wagner Ranch Cave 3; approximately 70 acres encompassing Hills and

Dales Pit; approximately 25 acres encompassing Helotes Hilltop and Helotes Blowhole caves; and approximately 75 acres on the Canyon Ranch property that encompass Scenic Overlook, Canyon Ranch Pit, and Fat Man's Nightmare caves. All of the off-site karst preserves contain endangered karst invertebrate species, as well as other cave-adapted species. A summary of endangered invertebrate species known, and how the identifications of each species were verified, from each of the proposed on- and off-site preserve caves is provided in Table 1.

The shape and size of Hills and Dales and Canyon Ranch karst preserves were largely designed based on hydrogeologic investigations and an assessment of the surface area necessary to sustain the karst ecosystems. However, Hills and Dales preserve contains most, but not all, of the surface drainage for the cave due to different ownership of those adjacent lands. The known extent of underground passage of each of the caves within these preserves is included within the karst preserves, as well as the area of native vegetation required for cave system integrity. These preserves include sufficient area to maintain the native plant communities that support the ecology of the caves and the habitat of the animals that provide nutrient input to the caves. The configuration of the Hills and Dales and Canyon Ranch preserves was also designed to minimize detrimental edge effects from adjacent development and maximize connectivity for normal dispersal of essential species. The size and shape of these preserves is based in part on the land surrounding the features that was practicably available for sale during preparation of the HCP

The Applicant's experienced, qualified consulting biologists are of the view that all of the on-site and off-site karst preserves are sufficient, with proper management, to sustain populations of the Covered Species indefinitely.

The Applicant reserves the right subject to Service approval to designate karst preserves in substitution for one or more of the proposed preserves described in this HCP. This flexibility is needed given the complexity of the various transactions needed to establish the preserves. If substitution is necessary, the Applicant with Service approval, may substitute another preserve of equivalent species value to meet the mitigation needs of this HCP prior to clearing or construction activities on the Property.

6.3 Karst Preserve Management and Monitoring

The karst preserves (181 acres) will be surveyed by a registered land surveyor and preserved in perpetuity by appropriate legal mechanisms, (e.g., conservation easements, deed restrictions which include boundary surveys) before clearing or construction begins on undeveloped portions of the Property. The Applicant may elect to identify a third-party, Service-approved conservation entity (Management) who will be responsible for operating, monitoring, and managing the preserves in perpetuity for the benefit of the Covered Species. The Implementing Agreement associated with this EA/HCP includes more specific provisions regarding transfer of the Preserves and conservation entities.

Should the permit be issued, the Permittee or Management will be responsible for operating, managing, and monitoring the preserves according to the provisions of the HCP. In places where

responsibilities of Management are referred to, this will mean the Permittee, if no Management entity has been designated.

Within six months of permit issuance, the Permittee or Management will complete Karst Preserve Management and Monitoring Plans (KMMP) for each preserve, in accordance with the provisions of this HCP, to be approved by the Service, which approval is not to be unreasonably withheld or delayed. Subsequent to issuance of the Permit, Management will operate, maintain, and monitor the Preserves in accordance with the relevant provisions of this HCP. The KMMPs will meet the following management objectives:

The management objectives of the off-site preserve KMMPs are to:

- maintain the habitat in the caves, which depends on a stable and mild temperature, high relative humidity, and appropriate nutrient and water input;
- maintain appropriate nutrient input to caves, including plant detritus, root masses, and feces, eggs, and/or dead bodies of animals that forage on the surface and bring nutrients into the cave;
- protect the karst ecosystems and Covered Species from damage or harm that could be caused by such things as vandalism, over-visitation, and contamination of the caves;
- maintain or improve the condition and viability of the surface native plant community; and,
- subject to limitations on the obligation of the Permittee to commit resources to adaptive management actions, undertake other activities as referred to in the adaptive management sections and found to be necessary for long-term conservation of the Covered Species.

The management objectives of the on-site preserve KMMPs are to attain the above objectives to the maximum extent possible considering the size of the preserves and the degree of impacts.

The KMMP procedures are an integral part of this EA/HCP. Although detailed KMMPs will be developed for each preserve assuming permit issuance, the following management and monitoring procedures are part of the EA/HCP and will be included and followed in preparation and implementation of the KMMPs.

6.3.1 Routine Inspections for On- and Off-site Preserves

- Site inspections of karst preserves will be conducted. Such inspections will be performed from the time of permit issuance. A site inspection form will be filled out by the site inspector and kept on file. Copies of these inspection forms will be presented as part of an annual management report to the Service. These regular inspections will include, but may not be limited to: signs of vandalism and unauthorized entry; damage to cave gates, fencing, and/or signs; damage to vegetation; presence of fire ants or other

non-native species; dumping; and any other conditions that could impact the listed species or the karst ecosystem.

- Site inspections every other month will cover Madla's, John Wagner's, Helotes Hilltop and Blowhole, and La Cantera's on-site preserves in their entirety.

- On a monthly basis, Hills and Dales and Canyon Ranch preserves will have the area within 500 feet of the cave entrances and any cave security fences inspected. The perimeter will be inspected two times a year. The rest of the property will be inspected annually. If trespassing is evident, it will be investigated when found.

- Conditions encountered during inspections will be addressed in accordance with the provisions elsewhere in Section 6.3.

6.3.2 Vegetation/Habitat Management for On- and Off-site Preserves

- Native vegetation will be maintained or improved within the karst preserves. No clearing, mowing, cutting, thinning, or other activity that removes native vegetation will occur within the karst preserves unless approved by the Service. A baseline vegetation survey will be conducted using a quantitative method to appraise the current condition of each karst preserve. These surveys will be conducted for La Cantera Caves #1 and #2 prior to initial clearing or construction on the eastern portion of the Property (east and south of La Cantera Parkway), and within six months of permit issuance for all off-site preserves. Specific techniques should be approved by the Service as part of the KMMPs. Pilot nested-plot techniques, add-on sample area techniques, or comparable techniques approved by the Service, will be used to construct and examine species-area curves to determine sampling intensity needed. Data collected for woodland areas should include species composition, density, dominance, importance, reproductive profile (size classes), and degree of openness of the canopy. Grassland areas should measure species composition, and relative species dominance and importance, percent total cover, percent bare ground, and rockiness of surface. Non-native species should be noted and their relative dominance and importance examined for both community components of the grassland/woodland habitat mosaic. This baseline information will be used to evaluate the degree of invasion by non-native species and the need for restoration or manipulation of the vegetation in the area to achieve the stated objectives of maintaining a viable native plant community. The KMMPs for each preserve will address any initial restoration and maintenance needs, and will be revised, with Service approval, as needed, based on results of vegetation surveys described below.

- It is possible that a prolonged drought could occur that would greatly increase the potential for a catastrophic wildfire event. In such a case, the security provided by the creation of fire breaks within preserve areas may outweigh the loss of a small amount of vegetation, but could increase exotics and non-native species including fire ants. The

Permittee or Management will seek prior Service approval prior to creating any fire breaks within preserve areas. In the event of a drought, signs will be placed at prominent locations around the preserve warning of fire hazard conditions.

- Every five years after the initial construction is initiated on the eastern portion of the Property (east and south of La Cantera Parkway) and thereafter until either five years after build-out of that portion of the property or expiration or termination of the permit occurs, a quantitative vegetation survey of the on-site La Cantera cave preserves will be done to examine the status of the vegetation and to evaluate any potential need for adaptive management. Decisions regarding adaptive management must be approved by the Service. Every 10 years after build-out and until the expiration or termination of the permit, quantitative vegetation surveys will be conducted. All vegetation surveys will be compared to prior years, with an evaluation of adaptive management needed. For off-site preserves quantitative surveys will also occur; however, they will occur every 10 years from the date of the initial survey until the expiration or termination of the permit. Lowest impact management techniques will be used and must be approved by the Service for appropriateness and minimal impacts to listed species from direct or indirect effects.

- If during surveys/site inspections by the Management or Permittee, during Service review of reports, or reports by a third party, a determination is made by the Service that destruction or deterioration of surface vegetation, deleterious shifts in community composition regardless of cause, an imbalance in community structure of the native plants (as evaluated against literature examining the typical mature vegetation composition for these community types), an increase in non-native flora, or an abnormal constituent of the dominant plant community within the karst preserves is/has occurred, then adjustments to the management program may be warranted. Such impacts could result from excessive drying of the plant community along the edges of the preserve, fire, storm damage, invasion of exotics, oak wilt, other disease, or other perturbations. Adjustments will be made promptly within a reasonable time by the Permittee or Management in consultation with the Service. Adjustments will not include expansion of any preserve areas at the expense of Management or the Permittee.

6.3.3 Red-Imported Fire Ant Control for On- and Off-site Preserves

- A fire ant control and treatment program will be detailed in each KMMP and conducted under the acknowledgment and approval of the Service. Such a program will include the removal of fire ants or any other non-native species that are likely to result in degradation of the protection and preservation of endangered invertebrate species or the ecosystems on which they depend. Fire ant control will be based on the following criteria, although adjustments may be made to this program with Service approval.

- Within 164 ft of the footprint of any karst features that have listed invertebrates or cave crickets, fire ant control is restricted to the use of boiling water or steam. One to four

gallons of boiling or near-boiling water should be poured directly onto the mounds. Small amounts (1-2 tsps.) of detergent may be added to the boiling water. More than 164 ft from the footprint of any karst feature, either boiling water, steam, or chemical baits (such as Amdro or Logic) may be used (see restrictions that follow). If chemical baits are used between 164 and 500 ft from a karst feature, the following protocols must be met: (1) baits must be placed in containers appropriate to allow fire ant access but that will allow baits to be removed at the end of the day, (2) the bait must be placed out in mid-morning, (3) the ground must be dry, (4) the ground temperature must be between 70°F and 95°F, (5) there must be no rain predicted for that day, and (6) all uneaten bait must be removed by sunset. If chemical baits are used more than 500 ft from any karst feature, the baits may be "broadcast", but the following protocols must be met: (1) the bait must be placed out in mid-morning, (2) the ground must be dry, (3) the ground temperature must be between 70°F and 95°F, (4) there must be no rain predicted for that day, (5) no more than 1.5 pounds of bait per acre may be used, and (6) broadcast baits should not be used if the presence of red-imported fire ants has not been verified within the previous year. If there are changes to the Service guidelines on fire ant control in the future and the Service believes these changes would be appropriate for these sites, those changes will be incorporated by the Management. Care should be taken to avoid misidentification of ant species and impacts to native ant species.

- Fire ant control will be conducted on the karst preserves at least twice a year in the spring and the fall. Monitoring for fire ants will be conducted at least twice a year immediately preceding the required biannual fire ant control. Monitoring must be conducted over the entire karst preserves and must be sufficient to yield actual fire ant mound densities, not merely indices of fire ant density. Counts of fire ant mounds in the vicinity of cave entrances (up to 164 ft) must be incorporated into the routine monitoring and maintenance schedule. Specific protocols for fire ant monitoring must be developed as part of each site's KMMP, and approved by the Service, before clearing or construction on the property may commence. An increase in the frequency of fire ant control will be required if either of the following conditions are met during any survey: (1) fire ant densities are greater than 40 mounds per acre or (2) there are greater than 40 mounds within 164 ft (the approximate cricket foraging radius) of the entrance to any karst feature that has listed species or cave crickets. If the density of fire ants does not go below both of the preceding levels after an increase in the frequency of fire ant control, the frequency of fire ant control must be increased again until the density of fire ants is below both of the levels by the next fire ant survey. Additionally, if fire ant mounds are ever observed within 33 ft of any karst feature on the karst preserves or if biological investigations find any fire ants within any cave that has endangered invertebrates or cave crickets, all mounds within 33 ft of that cave entrance must be treated within 15 days.

- If necessary to provide access for fire ant control, the Permittee or Management, with prior Service approval, may create rough-in trails suitable to allow 4x4 vehicle access to points within 50 feet of the caves. These rough-in trails will require minimum

trimming or clearing of vegetation and minimum ground disturbance. If the Service fails to approve any rough-in trail proposal by Permittee, the Service shall provide an alternative fire ant control technique for the applicable preserve.

- The Applicant believes that some of the fire ant control techniques or protocols specified above may be impractical or inefficient with respect to some of the preserves. It is anticipated that the Permittee and the Service will explore and detail in the KMMP's potential alternative techniques, such as high pressure steam systems and improved baiting protocols, as warranted on a site-specific basis.

6.3.4 Fencing, Signage, and Access Point Maintenance for On- and Off-site Preserves

- Access to the karst preserves will be restricted to authorized personnel and researchers approved by the Service and not objected to by Management.

- Cave security fences, with design and placement acceptable to the Service, will be installed around the on-site karst preserves prior to any site preparation, clearing, or construction activities. Consideration should be given to incorporating as much of the surface and subsurface hydrology as possible. Fences for off-site preserves will be installed within 6 months of permit issuance.

- Cave security fences will be a minimum of 6-ft high and of such construction that adults or children cannot easily climb over or crawl under the fence. However, the fence should also be designed so as not to prevent or deter small to medium-sized vertebrates that may be important components of the karst ecosystem from passing through the fence. This can be accomplished by leaving animals access holes, similar to those used in cave gates, at ground level for at least every 5 m (16 ft) of fence. John Wagner and Madla preserves will have this type of fence installed around the perimeter of the preserve. The Canyon Ranch caves will be incorporated within a single cave security fence. The best locations for this security fence should be identified in the KMMP and be far enough away that the entrances to the caves are not easily visible from outside the fence.

- Hills and Dales, Canyon Ranch, and Helotes Blowhole/Hilltop preserves will have barbed-wire fences composed of five strands installed around the entire preserve perimeter with associated no trespassing signs. Consideration will be given, subject to Service approval, to areas that may not require perimeter fencing due to their location adjacent to other open space. The Helotes Blowhole and Hilltop caves will be gated by Service approved gates. If vandalism or trespassing occurs on Hills and Dales and/or Helotes Blowhole/Hilltop preserves, the Service will determine if a cave security fence is necessary for either of these preserves. Adjustments will be made within 30 days of the Service's determination.

- Signs, to be approved by the Service, will be placed along all fences to further minimize the potential for vandalism and unauthorized access to the karst preserves.

- Karst preserves will have officially designated points of access or entry. Entry gates will remain locked at all times when unattended. Cave security fences and their signs and cave gates will be maintained and inspected by the Permittee or Management during routine inspections; barbed wire fences will be inspected at least every 6 months. Necessary repairs to fencing, gates, and signs will be initiated within one week if any of these are found to have incurred damage.

- If vandalism or trespassing occurs, the Service may determine that increased monitoring or security may be warranted which may include, but is not limited to, more frequent surveys of the fences, installing or improving cave gates, increased barb-wire strands, and/or installing cave security fences. Adjustments will be made promptly within a reasonable time in consultation with the Service.

6.3.5 Cave Gating for On- and Off-site Preserves

- Fencing the karst preserves and encouraging the growth of native vegetation to help conceal cave entrances should reduce the need for cave gates (cave gates are already installed on La Cantera caves #1 and #2 and Hills and Dales Pit). Both Helotes Hilltop and Helotes Blowhole caves will be gated within 6 months of permit issuance due to observations of vandalism and trespass. If unauthorized entry becomes a problem with the remaining caves despite perimeter and cave security fences, entrances of caves containing listed species within the karst preserves may need to be gated for the protection of the cave's contents and control of cave access. Existing cave gates may also need to be replaced, repaired, or removed. Cave gate design and placement must be approved by the Service. Cave gate installation or repair will occur promptly within a reasonable time in consultation with the Service unless otherwise specified in this HCP. Cave gates will meet all requirements, standards, and guidelines for design and application or installation for endangered invertebrate species habitat caves, as approved by the Service. All cave gates will be maintained and inspected by the Permittee or Management during routine inspections.

6.3.6 Control of Mammals for On- and Off-site Preserves

The following methods will be implemented, as necessary, to control the impacts from increasing population densities of white-tailed deer and other mammals on surface plant and animal communities. Any measures invoked will be in coordination with and approved by the Service.

- Deer and feral hogs often occur in greater density adjacent to suburban areas than in undeveloped areas due to greater availability of food. High densities of deer and feral hogs are known to have a long-term adverse effect on the abundance and distribution of trees, seedlings, and saplings by increasing

browsing pressure (deer) and uprooting vegetation (hogs). The subsequent decrease in the deciduous tree component of the wooded areas could lead to shifts in both plant and animal communities. For off-site preserves, if effects of excessive browsing pressure, a lack of oak seedling recruitment, and/or vegetation damage are found, the Permittee or Management will implement appropriate techniques to remedy these damages in coordination with and approval by the Service. Corrective actions will be taken promptly within a reasonable time in consultation with the Service. Such actions may include hunting, trapping, or other deer and hog population reduction programs. The karst preserves will be available for censussing conducted by the State or other agencies interested in assessing deer and feral hog population levels.

- Some mammals that provide nutrient input into karst ecosystems are also predators of insects and other fauna, and thus may potentially become a threat at higher densities, including raccoons, mice *(Peromyscus* sp.), opossums, and skunks. Domestic and feral cats and dogs and rats and mice associated with human habitation, may also impact native animal communities. Monitoring is needed to establish baseline densities of mammals and will be conducted following Service review and approval of the monitoring design and methodology as part of the KMMPs. A baseline survey for mammals will be conducted on the La Cantera cave preserves prior to initiation of construction activities on the Property and within one year of permit issuance on off-site preserves.

- Following initiation of construction on the Property or adjacent to off-site preserves, if the number of cave crickets or other native fauna that support the karst nutrient regime begin to decrease, additional monitoring will be conducted to determine if the number of mammals is changing (increasing or decreasing).

- If the number of mammals increases or decreases and is believed to be a threat to the karst ecosystems, a program to remedy the situation will be implemented. Such a program will only be implemented after approval from the Service, but within 6 months of detection.

- A wildlife biologist trained in plant ecology or a plant ecologist will conduct annual inspections of the off-site karst preserves to assess browse pressure, oak seedling recruitment, and vegetation damage from deer and feral hogs.

- If during surveys/site inspections by the Management or Permittee, during Service review of reports, or reports by a third party, a determination is made that evidence of excessive browsing pressure by deer; lack of sufficient oak seedling recruitment; wild hog damage; potentially harmful numbers of or an increase in non-native fauna within the karst preserves such as certain

cockroaches, rats, or imported fire ants; or an inadequate number (either too low or too high) of native vertebrates known to frequent the caves such as mice, amphibians, raccoons, and snakes has occurred, then adjustments to the management program may be warranted. Adjustments will be made promptly within a reasonable time in consultation with the Service.

6.3.7 Foreseeable Circumstances for On- and Off-site Preserves

Any circumstances detected in the preserves and detrimental to the Covered Species will trigger the need to consult with the Service for advice on adaptive management. In addition, the Permittee or Management will report to the Service within 24 hours of detection any site conditions or disturbances that pose an immediate risk to Covered Species.

The following measures are general procedures for dealing with foreseeable, but unpredictable, circumstances that could occur. With respect to these potential unpredictable circumstances, the Permittee or Management will be required to undertake such corrective actions, in consultation with the Service, as necessary to meet the goals and management objectives of this HCP:

- Vandalism of Caves or Karst Preserves. If detected, the Service as well as local law enforcement authorities will be promptly notified. Any effects of vandalism will be documented and then corrected promptly, in a reasonable time, with Service consultation and approval.

- Storm Damage. The Service will be notified of and damage will be assessed and documented within one week. Upon Service consultation and approval, corrective measures will be implemented promptly and within a reasonable time.

- Fire. Upon detection of a fire, whether wild or deliberate, the Permittee or Management will notify the local fire department first and then the Service. Immediately following extinguishment, or as soon as warranted by safety considerations, the Permittee or Management will assess any impacts and implement appropriate corrective actions approved by the Service. The time frame for implementing corrective actions will be determined through discussion with the Service.

- Release of Hazardous Materials. In the event of a release of chemicals, gasoline, oil, or other hazardous materials or a gas leak within or around the karst preserves, the Permittee or Management will immediately notify the local fire department that has the capability to respond to such incidents and then the Service. If appropriate and necessary, the Permittee or Management will also notify the TNRCC. As soon as warranted by safety considerations, the Permittee or

Management will assess any damages and take appropriate corrective action in consultation with the Service.

- Activities of Adjacent Landowners or Occupants. In the event that adjacent landowners or occupants conduct activities that may be damaging to the karst preserves (including, but not limited to, vandalism or trash dumping), the Permittee or Management will immediately implement appropriate corrective action in consultation with the Service.

6.3.8 Other Conditions for On- and Off-site Preserves

The following conditions will be included in all conservation easements and deeds:

- Cattle, other domestic and/or exotic livestock, and pets will not be allowed in the preserve areas unless approved by the Service.

- No fertilizers, herbicides, or pesticides will be used within the karst preserves unless approved by the Service.

- No new roads, new utilities, or other development including stormwater or wastewater lines, treatment ponds, structures or other facilities are allowed within karst preserve boundaries unless allowed for under this HCP or approved by the Service.

- Motorized vehicles will be prohibited from preserve areas at all times, unless utilized to facilitate operation, monitoring, and maintenance of preserve areas.

- No public access will be allowed on the karst preserves including hiking, biking, and horseback riding unless approved by the Service.

6.3.9 Monitoring In and Around the Cave for On- and Off-site Preserves

- The Permittee or Management will develop a monitoring plan in coordination with and subject to the approval of the Service as part of the KMMP. The monitoring plan needs to be designed to assess the status of the listed species, the karst ecosystem, and the effectiveness of management in meeting the goals and objectives of this HCP. In the event that elements of preserve management are not meeting these goals and objectives, monitoring will help determine what factors are most likely causing any declines or detrimental effects, so that effective management actions can be implemented and adjusted as needed.

- The monitoring plan needs to address components of both the surface and subsurface communities and environments that are important to the Covered Species. Methods should be designed to minimize impacts on the Covered Species. The monitoring program needs to be adequate to assess whether the Permittee or Management is

successful in conserving the Covered Species and to determine what factors may be contributing to any observed declines or deleterious effects. The monitoring plan will include, but is not limited to, the following components:

a. Baseline monitoring will begin prior to clearing and construction on the portion of the Property east of La Cantera Parkway for the La Cantera caves and within 6 months after permit issuance for off-site preserves.

b. Surveys for listed species within all caves with listed species will occur every year, and will be done at the same time of year (within 30 days) during the Spring (March through June) or Fall (September through December). Monitoring in all caves with listed species will include, but is not limited to:

1. all vertebrates and invertebrates, alive or dead, including all troglobites, troglophiles, trogloxenes, and accidental species;
2. quantities for each species (approximations may be made for very abundant species);
3. microhabitat descriptions and locations (maps and descriptions) within the cave of each listed species;
4. types (identified as specifically as possible) and approximate quantities of other organic matter including leaf litter, fungus, feces, bones;
5. sign of mammal or other trogloxene or accidental vertebrates (for example, scratch marks, middens, nesting materials, shed skins);
6. Temperature and humidity within the cave at the time of the survey, recorded with equipment other than the dataloggers.

c. Monitoring of the cave environment (temperature and humidity) within each endangered species cave will be continuously recorded on a 24-hour basis with automated dataloggers. These data will be downloaded during the annual cave interior monitoring. Additionally, cave cricket abundance surveys will be conducted twice a year and will always be done at the same time of year (within 30 days) during the Spring (March through June) and Fall (September through December) unless otherwise approved by the Service.

d. Measurements of surface temperature and relative humidity and notations made of recent weather events (for example, drought, recent rain, heat waves, cold spells, tornados) will be reported for each of the monitoring visits described above.

e. Monitoring of the surface community for:

1. imported fire ants (see section on Red-Imported Fire Ant Control);

2. status and changes in vegetation (see section on Vegetation/Habitat Management);
3. numbers of mammals that may be either beneficial or detrimental to the karst ecosystem and the surface community on which it depends (mice and other small mammals, raccoons, deer, feral hogs, and feral or stray cats and dogs);
4. browse pressure, oak seedling recruitment, and vegetation damage from deer or feral hogs;
5. invertebrate abundance in leaf litter.

6.3.10 Adjustments to the Management Plan

- If during surveys/site inspections by the Management or Permittee, during Service review of reports, or reports by a third party, a determination is made by the Service that the goals or management objectives of this HCP are not being met, or management and/or monitoring activity is determined not to be effective in conserving a Covered Species, then adjustments to the management program may be warranted. Adjustments will be made promptly within a reasonable time in consultation with the Service unless specified elsewhere in this HCP. Conditions not already mentioned in the Karst Preserve Management and Monitoring Section (6.3) may also warrant such adjustments and include, but are not limited to, the following:

    - destruction or deterioration of subterranean habitat (which could be due to a number of factors including, but not limited to, drying, loss of water inputs, and point-source and non-point source pollution),
    - a single drastic or consistent gradual decline in the number of observed Covered Species, cave crickets, or other native species that normally inhabit the caves,
    - declines in measured relative humidity or increased variation in measured temperature or shifts from suitable temperatures,
    - new information on the biology of the Covered Species, or
    - evidence of loss of structural integrity of one or more caves such as collapse or large breakdown in the cave interior or entrance.

- Adaptive management options to be considered may include, but are not limited to:

    - replacement or modification of the karst preserve perimeter fence and/or installation of interior cave security fencing around specific caves;
    - installation, replacement, or repair of cave gates;
    - hunting, trapping, or other deer and hog reduction programs;
    - irrigation of the karst preserve to preserve appropriate humidity levels in caves or to maintain vegetation integrity;
    - vegetation control or plantings to achieve trespass deterrence, runoff control, improved nutrient input, cave cricket forage, re-establishment of native floral species, or cave temperature and moisture regulation;

- modification of drainage patterns within and around the karst preserves;
- for the plant community--thinning of the canopy, removal of selected individuals, control of exotic species, prescribed fire away from immediate cave areas, replanting native species that are under-represented, oak wilt control, and other suitable restoration activities approved by the Service;
- modifications to fire ant treatments (such as increasing the frequency of treatments);
- actions to reduce the number of mammalian predators;
- physical reinforcement of a cave(s) or cave entrance(s);
- activities may also be needed to address root causes of poor reproduction of the plant community or survivorship (such as control of seed predators, browsers, disease, etc); and,
- installation of a barrier between developed areas and the preserve to prevent, ameliorate, or deter deleterious impacts from the developed area.

6.3.11 Limitation of Resource Commitments for Management and Adaptive Management Actions

- It would be economically infeasible and impracticable for the Permittee or Management to commit to future management, monitoring, repair, and adaptive management actions without regard to available funding. For this reason, and in accordance with Service policy (*see* 65 Fed Reg 35253 (June 1, 2000)), the purpose of this provision is to describe the level of funding commitment of the Applicant towards management, monitoring, repair, and adaptive management actions and to "clearly state the range of possible operating conservation program adjustments due to significant new information, risk, or uncertainty." Notwithstanding anything contained in this HCP to the contrary, nothing in this HCP, and no adaptive management actions, shall require Management or Permittee to commit any additional land or funding for the acquisition or conservation of additional land beyond the karst preserves specified herein. Management, monitoring, repair, and adaptive management actions will be accomplished, to the extent practicable, and exclusively through the Total Funding Commitment (as described below) or a reallocation of such funding commitment to the conservation program, such as by shifting funding from one management action to a new action or by accelerating planned future funding for current adaptive management actions with a concomitant reduction in future funding obligation.

- The Applicant, based on review of available information, estimates, and budgets, commits that it will provide funding for all management, monitoring, repair and adaptive management actions described in this HCP up to an aggregate of $38,032.00 per year, as adjusted for inflation as described below, for all on-site and off-site preserves (the "Base Funding Commitment"), and in addition to such Base Funding Committment any "Rollover Fund" (defined below). The aggregate of the Base Funding Commitment and the Rollover Fund, if any, is referred to as the "Total Funding Commitment." This Total Funding Commitment has been established through discussions with the Service

and includes an amount necessary to cover management, monitoring, repair, and adaptive management actions described in this HCP. In any year in which the entire Base Funding Commitment is not expended, the savings from that year will be 'rolled over' and available for use in the future years ("Rollover Fund"). In other words, the amount added to the Rollover Fund for any given year will be the Base Funding Commitment less the portion of the Base Funding Commitment actually expended in that year. For the second through fifth years after permit issuance, the Base Funding Commitment will be increased each year by an amount commensurate with any increase in the consumer price index (CPI) for the San Antonio metropolitan area for the previous year. After the fifth year, the Base Funding Commitment will be increased annually by an amount equal to the previous year's CPI increase multiplied by the amount of Base Funding Commitment actually expended in that previous year. At such time as a preserve is transferred to a third party, inflation adjustments to that third party's Base Funding Commitment will be based on a projected inflation rate of 3.5%. When the karst preserves are conveyed to a third party approved by the Service (pre-approved third-parties will be listed in Section 12.0 of the Implementing Agreement), the Permittee may establish an endowment for the management, monitoring, repair, reporting, and adaptive management of the karst preserves and the transferree (and its successors) shall be responsible for and shall assume in writing the management, monitoring, repair, reporting, and adaptive management terms of the HCP. At such time as the Permittee desires to transfer one or more , but less than all, of the preserves to Management, the Permittee will propose to the Service a base funding commitment per year for those preserves to be derived as an allocation from the Base Funding Commitment, and a rollover fund for those preserves as an allocation from the Rollover Fund, such rollover commitment not to be less than $11,000, and leaving a Rollover Fund balance of at least $11,000 for the remaining preserves not being transferred. Within thirty (30) working days after the Service's receipt of such proposal, the Service will either approve it or specify an allocation acceptable to the Service. In the event the Service does not respond within said thirty (30) working days, the proposed allocation will be deemed accepted. The $11,000 figure was arrived at by the Permittee's review of costs associated with certain potential contingencies, such as fencing and cave gate repairs due to vandalism and unusual levels of fire ant treatment, using customary business practices for estimating contingencies.

- In addition, subject to the limitations stated herein, the Permittee and/or Management, as applicable, will cooperate with the Service for the implementation of management, monitoring, or adaptive management actions to be funded by the Service separate above and beyond that agreed to by the Permittee under this HCP. The Applicant has provided the Service with a schedule of projected expenses on which the Base Funding Commitment was based. This schedule does not include initial capital costs in connection with acquiring, fencing, and gating the preserves, which capital costs the Applicant has committed to fund at the establishment of the preserves in addition to the Base Funding Commitment.

6.4 Development Area

The following conditions only relate to the Property:

- An integrated pest management program (IPM), including consideration of fire ants, shall be adopted prior to any construction or clearing activities on the Property and will be implemented by the Permittee and/or Participants (as further described in the Implementing Agreement). The goal of the IPM is to minimize chemical use, including pesticides and fertilizers, while still maintaining a natural balance.

- Drainage from developed areas shall be channeled into curbed roadways or other confined drainages and then diverted away from the two one-acre preserves.

- Utility lines including sewer and water will not be placed within the preserve areas.

- The following uses that have a significant potential to contaminate sub-surface karst and/or groundwater shall be prohibited on the eastern portion of the Property that lies within the boundaries of La Cantera Parkway, Loop 1604, and I-10--gas stations, dry cleaners (on-site cleaning process), metal or chemical processing or manufacturing facilities, hazardous waste facilities, and septic tanks, plus any other uses prohibited by the TNRCC or the City of San Antonio. Storage of emergency supplies of fuel such as for auxiliary generators for commercial buildings shall be permitted in compliance with applicable Federal, State, and local laws.

- The Permittee or Participants will prohibit the use of deer feeders and bird seed feeders in residential yards within 500 ft of the preserves through deed restrictions.

6.5 Construction Practices

- Construction period erosion and siltation management will meet, at a minimum, City of San Antonio and TNRCC code requirements and protocols for storage, use and spill containment, and countermeasures for construction-related chemical and petroleum products. Gas and oil shall not be stored on the eastern portion of the Property that lies within the boundaries of La Cantera Parkway, Loop 1604, and I-10; provided, however, that small amounts may be stored for emergency power generators.

- Construction of all wastewater pipelines will be at least as protective as current TNRCC aquifer protection rules.

- If any caves or subterranean voids are encountered during construction, the Permittee will have a qualified geologist respond immediately to evaluate the void geologically and issue specific instructions in accordance with standard practices accepted by TNRCC, as applicable, for the immediate closing of the void and the resumption of the work. Construction activity may resume immediately upon closing or filling of the void.

6.6 Funding for the HCP

The Permittee or Management, as applicable, will fund performance of the various conservation actions described in this HCP, subject to the limitations on the commitment of resources described in Section 6.3.11 above. The Permittee and Service-approved potential Management to be described in the Implementing Agreement are considered to have adequate financial strength to support this funding commitment.

6.7 No Surprises And Unforeseen Circumstances

The Applicant intends that the permit proposed to be issued under ESA Section 10(a)(1)(B) will include "assurances provided to the Permittees in case of changed or unforeseen circumstances" pursuant to and to the maximum extent available under 50 CFR Part 17 (including without limitation Sections 17.3, 17.22, and 17.32). These assurances are generally and collectively referred to as the "no surprises rule." Currently, the "Covered Species" in Section 6.7.1 of this HCP are considered adequately covered under this HCP and will, therefore, be covered by the no surprises rule assurances. From time to time during the duration of this HCP, upon the request of the Permittee, the Service will extend no surprises rule assurances to cover additional listed or unlisted species that might be affected by development of the Property provided such species are "adequately covered" under this HCP within the meaning of 50 CFR Section 17.3.

The Covered Species (*R. infernalis, R. exilis, C. madla*) are the only listed species known to occur in the UTSA Karst Region and only one or two (*R. exilis* and possibly *C. madla*) have been documented on the Property. These three species are well represented in the mitigation caves.

Of the six other endangered karst invertebrate species in Bexar County, none have been documented in the karst region in which the Property is located and all are considered unlikely to occur there. That fact, in combination with the extensive level of karst surveys on the Property, make it extremely unlikely that a previously undetected void containing habitat suitable for other listed karst invertebrates will be encountered.

Due to the preservation of La Cantera caves #1 and #2 and the scientific research the Permittee will be performing and/or funding, to the extent other listed karst invertebrates are found through monitoring of La Cantera caves #1 or #2, no additional mitigation or conservation actions will be required.

6.7.1 Covered Species

Species adequately covered under the HCP

Order Araneae
Family Agelenidae
Genus *Cicurina*
Species *madla* (Madla Cave meshweaver)

Order Coleoptera
Family Carabidae
Genus *Rhadine*
Species *exilis*, *infernalis* (no common names)

6.8 Reporting and Compliance

The Permittee and/or Management shall submit an Annual Report of preserves management and monitoring to the Service on October 1 of each year the permit is in effect. This report will include, but is not limited to, implementation of mitigation measures, inspection forms, results of regular inspections, management actions taken, any damage occurring and corrective actions taken, species and cave monitoring results (including copies of monitoring forms), and a report on the status of each listed species within the preserves.

Upon written notification to the Permittee or Management, the Service will be allowed access to the karst preserves to inspect the condition of the caves and preserves to ensure that the HCP is being implemented according to its terms for the benefit of the listed species. In the event that the Service finds that the HCP is not being implemented according to its terms, the Service has the option as a last resort of terminating and revoking the permit. Prior to revocation, the Service will exercise all possible measures to remedy the situation.

In addition, the Service will include the following conditions in the permit:

Written annual reports of the year's activities will be submitted by October 1 of each year to the U.S. Fish and Wildlife Service Office, 10711 Burnet, Suite 200, Austin, Texas 78758; and to the U.S. Fish and Wildlife Service Office, 500 Gold Ave. SW, Room 4012, Albuquerque, New Mexico 87102.

Upon locating a dead, injured, or sick listed karst invertebrate, or any other endangered or threatened species, Permittees are required to contact the Service's Law Enforcement Office, San Antonio, Texas, (210) 681-8419, for care and disposition instructions. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling

dead specimens to preserve biological materials in the best possible state for analysis of cause of death. In conjunction with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, the Permittees and their contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

Conditions of this permit shall be binding on and for the benefit of the Permittees and their respective successors and assigns. If the permit requires an amendment because of change of ownership, the Service will process that amendment without the requirement of the Permittees preparing any new documents or providing any mitigation over and above that required in the original permit. The construction activities proposed or in progress under an original permit may not be interrupted provided the required conditions of an issued permit are being followed.

If during the tenure of this permit the project design and/or the extent of the habitat impact described in the habitat conservation plan is altered, such that there may be an increase in the anticipated take of the karst invertebrates, the Permittees are required to contact the Service and obtain authorization and/or amendment of the permit before commencing any construction or other activities that might result in take beyond that described in the EA/HCP.

6.9 Amendment Procedure

It is necessary to establish a procedure whereby the Section 10(a)(1)(B) permit and its associated Implementation Agreement can be amended. However, it is important that the cumulative effect of amendments will not jeopardize any endangered or other rare species. Amendments must be evaluated based on their effect(s) on the habitat as a whole. The Service must be consulted on all proposed amendments. The types of proposed amendments and the applicable amendment procedures are as follows:

6.9.1 Amendments to Locally Approved Development Plans

It is acknowledged that upon the written request of the Permittees, the local agency having land use regulatory jurisdiction is authorized in accordance with applicable law to approve amendments to development plans for the subject development area that do not encroach on any endangered species habitat that is not presently contemplated to be taken as a consequence of the development and that do not alter the conditions set forth in the HCP.

6.9.2 Minor Amendments to the HCP

Minor amendments involve routine administrative revisions, changes to the operation and management program, or minor changes to the development envelope and changes in land use in the development area that do not diminish the level or means of mitigation or increase the

impacts to the species or their habitats. Changes in ownership and permit assignment will also be handled through minor amendments and in accordance with the procedures in 50 CFR Section 13.25. Such minor amendments do not materially alter the terms of the Section 10(a)(1)(B) Permit.

Upon the written request of the Permittee, the Service is authorized to approve minor amendments to the HCP upon information notice sent to the parties to the Implementation Agreement if the amendment does not conflict with the primary purposes of this EA/HCP as stated in Section 2.0 and Section 6.0 of this EA/HCP.

6.9.3 All Other Amendments

All other amendments will be considered an amendment to the Section 10(a)(1)(B) permit, subject to any other procedural requirements of Federal law or regulation that may be applicable to amendment of such a permit.

6.10 Duration

This HCP is written in anticipation of issuance of an ESA Section 10(a)(1)(B) permit for a period of 30 years.

7.0 PUBLIC AND AGENCY COORDINATION

The following agencies, organizations, and individuals were consulted or coordinated with during the process of addressing endangered species concerns for the La Cantera incidental take permit applications:

City of San Antonio
James Reddell, Texas Memorial Museum - Austin, Texas
James Cokendolpher, Lubbock, Texas
Mike Wharton, Mike Wharton and Associates - Austin, Texas
Pape-Dawson Engineers - San Antonio, Texas
SWCA, Inc. - Austin, Texas

Table I-15. Summary of Survey Results for All Extant Karst and Geologic Features on the La Cantera Property.

SWCA	Horizon	Raba-Kistner	Additional Investigation of Feature	Habitat for Listed Karst Invertebrates
F-1			None	
F-2			None	
F-3			None	
F-4			None	
F-5			None	
F-6			None	
F-7			None	
F-8	S-21		None	
F-9	S-19	S-98	Excavated by Horizon 11/00	No
F-10			None	
F-11	S-17		Excavated by Horizon 11/00	No
F-12	S-24	S-99	None	
F-13	S-25		None	
F-14	S-18		Excavated by Horizon 11/00	No
F-15			None	
F-16			None	
F-17			None	
F-18			Excavated by SWCA	No
F-19		S-92	None	
F-20		S-35	None	
F-21			None	
F-22	S-49		Excavated by SWCA	No
F-23			None	
F-24		S-25	None	
F-25			Excavated by SWCA	No
F-26	A-12	S-5	None	
F-27			None	
F-28			None	
F-29		S-111	None	
F-30	S-30	S-14	None	
F-31			None	
F-32	S-38	S-108	Excavated by SWCA (9/97) and Horizon 11/00	No
F-33		S-52	None	
F-34		S-56	None	
F-35			None	
F-36			None	
F-37			Excavated by SWCA	No
F-38		S-60	None	
F-39	S-29	S-74	Biota Surveys in 1993, 1994, 1995, and 2000	Yes: *Cicurina sp.* (eyeless)
F-40			None	
F-41			None	
F-42	S-12		None	
F-43			None	
F-44	S-40; S-39		Excavated by SWCA	No
F-46			None	

Table I-15. Summary of Survey Results for All Extant Karst and Geologic Features on the La Cantera Property. (Continued)

SWCA	Horizon	Raba-Kistner	Additional Investigation of Feature	Habitat for Listed Karst Invertebrates
F-47			None	
F-48		S-21	None	
F-49		S-115	None	
F-50	S-03	S-7	None	
F-51	S-01		None	
F-52			None	
F-53	S-02		None	
F-54	S-04		None	
F-55			None	
F-56			None	
F-57	A-09		None	
F-58			None	
F-59			None	
F-60			None	
F-61	S-53		Excavated by SWCA	No
F-62			None	
F-63	A-11	S-186	Excavated by SWCA	No
F-64		S-179	None	
F-66	A-06	S-188	Excavated by SWCA	No
F-67			None	
F-68			Excavated by SWCA	No
F-69		S-179	None	
F-70		S-179	None	
F-71		S-179	None	
F-72		S-176	None	
F-73		S-177	Excavated by SWCA	No
F-74	A-07	S-188	Excavated by SWCA	No
F-75			None	
F-76		S-176	None	
F-77		S-176	Excavated by SWCA	No
F-78			None	
F-79			None	
F-80		S-122 ?	None	
F-81			None	
F-82			None	
F-83			None	
F-84		S-19	None	
F-85			None	
F-86			None	
F-87			None	
F-88			None	
F-89			None	
F-90			None	
F-91			Excavated by SWCA	No
F-92			None	
F-93			None	
F-94			None	

Table I-15. Summary of Survey Results for All Extant Karst and Geologic Features on the La Cantera Property. (Continued)

SWCA	Horizon	Raba-Kistner	Additional Investigation of Feature	Habitat for Listed Karst Invertebrates
F-95	S-51		Excavated by SWCA	No
F-96			None	
F-97			None	
F-98	S-37		None	
F-99			None	
F-100			None	
F-101			None	
F-102			None	
F-103			None	
F-104			None	
F-105			None	
F-106			None	
F-107			None	
F-108			None	
F-109			None	
F-110			None	
F-111			None	
F-112			None	
F-114			None	
F-115			None	
F-116			None	
F-117	S-28		Excavated by SWCA	No
F-118			None	
F-119			Excavated by SWCA	No
F-120			Excavated by SWCA	No
F-121			None	
F-122			None	
F-123			None	
F-124			None	
F-125			None	
F-129			Excavated by SWCA	No
F-130			Excavated by SWCA	No
F-132			None	
F-134			None	
F-135			None	
F-136			None	
F-138			Excavated by SWCA	No
F-139			None	
F-140			None	
F-141			None	
F-142			None	
F-143			None	
F-144			Excavated by SWCA	No
F-145			None	
F-147			None	
F-149			None	
F-152			None	

Table I-15. Summary of Survey Results for All Extant Karst and Geologic Features on the La Cantera Property. (Continued)

SWCA	Horizon	Raba-Kistner	Additional Investigation of Feature	Habitat for Listed Karst Invertebrates
F-153			None	
F-154			None	
F-155			None	
F-158			Excavated by SWCA	No
F-159			Excavated by SWCA	No
F-160			None	
F-161			None	
F-162			None	
F-163			Excavated by SWCA	No
F-164			None	
F-165			None	
F-166			None	
F-167			None	
F-168			None	
F-172			None	
F-177			None	
F-178			Excavated by SWCA	No
F-180			None	
F-182			None	
F-183			None	
F-185			None	
F-186			None	
F-192			None	
F-193			None	
F-194			None	
F-195			None	
F-197			None	
F-198			None	
F-199			None	
F-200			Excavated by SWCA	No
F-201			None	
F-202			None	
F-203			None	
F-204			Excavated by SWCA	No
F-205			None	
F-206			None	
F-207			Excavated by SWCA	No
F-208			Excavated by SWCA	No
F-209			None	
F-210			None	
F-211			None	
F-212			Excavated by SWCA	No
F-213			None	
F-214			None	
F-215			None	
F-216	A-05	S-184	Excavated by SWCA, 9/97; Biota Surveys 1993, 1994, 1995, 2000	Yes: *Rhadine exilis*; *Cicurina sp.* (eyeless)

Table I-15. Summary of Survey Results for All Extant Karst and Geologic Features on the La Cantera Property. (Continued)

SWCA	Horizon	Raba-Kistner	Additional Investigation of Feature	Habitat for Listed Karst Invertebrates
F-217	A-04	S-102	Excavated by SWCA, 9/97; Biota Surveys 1993, 1994, 1995, 2001	Yes: *Rhadine exilis*; *Cicurina sp.* (eyeless)
	A-10		None	
	S-05		None	
	S-06		None	
	S-07		Excavated by Horizon 11/00	No
	S-08		Excavated by Horizon 11/00	No
	S-09		Excavated by Horizon 11/00	No
	S-10		None	
	S-13		None	
	S-14		None	
	S-15		None	
	S-16		None	
	S-20		Excavated by Horizon 11/00	No
	S-22		None	
	S-23		None	
	S-26		None	
	S-27		None	
	S-31		None	
	S-32		None	
	S-33		Excavated by Horizon 11/00	No
	S-34		None	
	S-36		None	
	S-39		None	
	S-41		None	
	S-42		None	
	S-43		None	
	S-44		None	
	S-45		None	
	S-46		Excavated by SWCA	No
	S-47		None	
		S-1	None	
		S-2	None	
		S-3	None	
		S-4	None	
		S-6	None	
		S-8	None	
		S-9	None	
		S-10	None	
		S-11	None	
		S-12	None	
		S-13	None	
		S-15	None	
		S-16	None	
		S-17	None	
		S-18	None	
		S-20	None	

Table I-15. Summary of Survey Results for All Extant Karst and Geologic Features on the La Cantera Property. (Continued)

SWCA	Horizon	Raba-Kistner	Additional Investigation of Feature	Habitat for Listed Karst Invertebrates
		S-22	None	
		S-23	None	
		S-24	None	
		S-26	None	
		S-27	None	
		S-28	None	
		S-29	None	
		S-30	None	
		S-31	None	
		S-32	None	
		S-33	None	
		S-34	None	
		S-36	None	
		S-37	None	
		S-38	None	
		S-39	None	
		S-40	None	
		S-41	None	
		S-42	None	
		S-43	None	
		S-44	None	
		S-45	None	
		S-46	None	
		S-47	None	
		S-48	None	
		S-49	None	
		S-50	None	
		S-51	None	
		S-53	None	
		S-54	None	
		S-55	None	
		S-57	None	
		S-58	None	
		S-59	None	
		S-61	None	
		S-62	None	
		S-63	None	
		S-64	None	
		S-65	None	
		S-66	None	
		S-67	None	
		S-68	None	
		S-69	None	
		S-70	None	
		S-71	None	
		S-72	None	
		S-73	None	

Table I-15. Summary of Survey Results for All Extant Karst and Geologic Features on the La Cantera Property. (Continued)

SWCA	Horizon	Raba-Kistner	Additional Investigation of Feature	Habitat for Listed Karst Invertebrates
		S-75	None	
		S-76	None	
		S-77	None	
		S-78	None	
		S-79	None	
		S-80	None	
		S-81	None	
		S-82	None	
		S-83	None	
		S-84	None	
		S-85	None	
		S-86	None	
		S-87	None	
		S-88	None	
		S-89	None	
		S-90	None	
		S-91	None	
		S-93	None	
		S-94	None	
		S-95	None	
		S-96	None	
		S-97	None	
		S-100	None	
		S-101	None	
		S-103	None	
		S-104	None	
		S-105	None	
		S-106	None	
		S-107	None	
		S-109	None	
		S-110	None	
		S-112	None	
		S-113	None	
		S-114	None	
		S-116	None	
		S-117	None	
		S-118	None	
		S-119	None	
		S-120	None	
		S-121	None	
		S-123	None	
		S-124	None	
		S-125	None	
		S-126	None	
		S-127	None	
		S-128	None	
		S-129	None	

Table I-15. Summary of Survey Results for All Extant Karst and Geologic Features on the La Cantera Property. (Continued)

SWCA	Horizon	Raba-Kistner	Additional Investigation of Feature	Habitat for Listed Karst Invertebrates
		S-130	None	
		S-131	None	
		S-132	None	
		S-133	None	
		S-134	None	
		S-135	None	
		S-136	None	
		S-137	None	
		S-138	None	
		S-139	None	
		S-140	None	
		S-141	None	
		S-142	None	
		S-143	None	
		S-144	None	
		S-145	None	
		S-146	None	
		S-147	None	
		S-148	None	
		S-149	None	
		S-150	None	
		S-151	None	
		S-152	None	
		S-153	None	
		S-154	None	
		S-155	None	
		S-156	None	
		S-157	None	
		S-158	None	
		S-159	None	
		S-160	None	
		S-161	None	
		S-162	None	
		S-163	None	
		S-164	None	
		S-165	None	
		S-166	None	
		S-167	None	
		S-168	None	
		S-169	None	
		S-170	None	
		S-171	None	
		S-172	None	
		S-173	None	
		S-174	None	
		S-175	None	
		S-178	None	

Table I-15. Summary of Survey Results for All Extant Karst and Geologic Features on the La Cantera Property. (Continued)

SWCA	Horizon	Raba-Kistner	Additional Investigation of Feature	Habitat for Listed Karst Invertebrates
		S-180	None	
		S-181	None	
		S-182	None	
		S-183	None	
		S-185	None	
		S-187	None	
		S-189	None	
		S-190	None	
		S-191	None	
		S-192	None	
		S-193	None	
		S-194	None	
		S-195	None	
		S-196	None	
		S-197	None	
		S-198	None	
		S-199	None	
		S-200	None	

8.0 REFERENCES CITED

Andren, H. 1995. Effects of landscape composition on predation rates at habitat edges. In: Mosaic Landscapes and Ecological Processes. L. Hansson, L. Fahrig and G. Merriam, eds. Chapman and Hall, London.

Barr, T.C. 1968. Cave ecology and the evolution of troglobites. Evolutionary Biology 2: 35-102.

Biological Advisory Team. 1990. Comprehensive report of the Biological Advisory Team. Austin, Texas. 80 pp.

Bowers, M., K. Greario, C.J. Brame, S.F. Matter, and J.L. Dooley, Jr. 1996. Use of space and habitats by meadow voles at the home range, patch and landscape scales. Oecologica 105: 107-115.

Burke, D.M. and E. Nol. 1998. Influence of food abundance, nest-site habitat, and forest fragmentation on breeding ovenbirds. The Auk 115(1): 96-104.

Buszka, Paul M. 1987. Relation of water chemistry of the Edwards aquifer to hydrogeology and land use, San Antonio region, Texas. U.S. Geological Survey Water-Resources Investigation Report 87-4416, 100 pp.

Crawford, R.L. and C.M. Senger. 1988. Human impacts to populations of a cave dipluran (Campodeidae). Proceedings of the Washington State Entomological Society 49: 827-830.

Crist, T.O. and R.G. Ahern. 1999. Effects of habitat patch size and temperature on the distribution and abundance of ground beetles (Coleoptera: Carabidae) in an old field. Environmental Entomology 26: 681-689.

Culver, D.C. 1986. Cave fauna. Pages 427-443 In: Conservation Biology: The Science of Scarcity and Diversity. M.E. Soule, ed. Sinauer Associates. Sunderland, Massachusetts.

Diamond, J.M. 1975. The Island Dilemma: Lessons of Modern Biogeographic Studies for the Design of Natural Reserves. Biological Conservation 7: 129-146.

Didham, R. 1998. Altered leaf-litter decomposition rates in tropical forest fragments. Oecologia 116: 397-406.

Dunlap, K. 1995. Inexpensive (and easy) temperature monitoring in caves. Pages 76-87 In: 1995 National Cave Management Symposium Proceedings. G.T. Rea, ed. Indiana Karst Conservancy, Inc. Indianapolis, Indiana.

Elliott, W.R. and J.R. Reddell. 1989. The status and range of five endangered arthropods from caves in the Austin, Texas, region. A report on a study supported by the Texas Parks and Wildlife Department and the Texas Nature Conservancy for the Austin Regional Habitat Conservation Plan.

Elliott, W. R. 1994. Community ecology of three caves in Williamson County, Texas: A three-year summary. 1993 Annual Report for Simon Development Co., Inc., U.S. Fish and Wildlife Service, and Texas Parks and Wildlife. August 30, 1994.

Fajer, E.D., M.D. Bowers, and F.A. Bazzaz. 1989. The effects of enriched carbon dioxide atmospheres on plant-insect herbivore interactions. Science 243: 1198-1200.

Hanski, I. 1995. Effects of landscape pattern on competitive interactions. In: Mosaic Landscapes and Ecological Processes. L. Hansson, L. Fahrig and G. Merriam *eds*. Chapman and Hall, London.

Harris, L. 1984. The Fragmented Forest: Island Biogeography Theory and the Preservation of Biotic Diversity. University of Chicago Press. Chicago, Illinois.

Helf, K., T. Poulson, and K. Lavoie. 1995. Protection and management of the cave cricket (*Hadenoecus subterraneus*) at Mammoth Cave National Park. National Cave Management Proceedings. Indiana karst Conservancy, Inc. Indianapolis, Indiana.

Hill, J.K., C.D. Thomas, and O.T. Lewis. 1996. Effects of habitat patch size and isolation on dispersal by Hesperia comma butterflies: implications for metapopulation structure. Journal of Animal Ecology 65: 725-735.

Holmes, E.E., M.A. Lewis, J.E. Banks, and R.R. Veit. 1994. Partial differential equations in ecology: spatial interactions and population dynamics. Ecology 75: 17-29.

Horizon Environmental Services, Inc. 2000. Karst investigation 136-acre La Cantera retail property at Loop 1604 and La Cantera Boulevard San Antonio, Bexar County Texas. Unpublished report prepared for The Rouse Company, Columbia, Maryland.

Howarth, F.G. 1983. Ecology of cave arthropods. Annual Review of Entomology 28: 365-389.

Howarth, F.G. 1988. Environmental ecology of North Queensland caves: or Why are there so many troglobites in Australia. 17th Biennial Conference. Australian Speleological Federation Tropicon Conference, Lake Tinaroo, Far North Queensland. L. Pearson, ed. Australian Speleological Federation, Cairns.

Jackson R.B., L.A. Moore,W.A. Hoffman, W.T. Pockman, and C.R. Linder. 1999. Ecosystem rooting depth determined with caves and DNA. Proceedings of the National Academy of Science 96: 11387-11392.

Jiquan, Chen, J. Franklin, and T.A. Spies. 1992. Vegetation responses to edge environments in old growth Douglas-fir forests. Ecological Applications 2: 387-396.

Kapos,V., G. Ganade, E. Matusui, and R.L. Victoria. 1993. Carbon 13 isotope as an indicator of edge effects in tropical rainforest reserves. Journal of Ecology 81: 425-432.

Keith, L., S. Bloomer, and T. Willebrand. 1993. Dynamics of a snowshoe hare population in fragmented habitat. Canadian Journal of Zoology 71: 1385-1392.

Kelly, P.A. and J.T. Rotenberry. 1993. Buffer zones for ecological reserves in California: replacing the guesswork with science. In: Interface Between Ecology and Land Development in California. J.E. Keeley ed. Southern California Academy of Sciences, Los Angeles.

Kindvall, O. 1992. Geometrical factors and metapopulation dynamics of the bush cricket, *Metrioptera bicolor* Philippi (Orthoptera: Tettigoniidae). Conservation Biology 6: 520-529.

Kindvall, O. 1999. Dispersal in a metapopulation of the bush cricket, *Metrioptera bicolor* (Orthoptera: Tettigoniidae). Journal of Animal Ecology 68: 172-185.

Kipp, Gayle K., Philip T. Farrington, and Michael J. Albach. 1993. Urban development on the Edwards aquifer recharge zone. Staff report to the Edwards Underground Water District Board of Directors, 80 pp.

Kotanen, P.M., J. Bergelson, and D.L. Hazlett. 1998. Habitats of native and exotic plants in Colorado shortgrass steppe: a comparative approach. Canadian Journal of Botany 76: 664-672.

Kozlov, M. 1996. Patterns of forest insect distribution within a large city: microlepidoptera in St. Peterburg, Russia. Journal of Biogeography 23: 95-103.

Kutac, E. A. and S. C. Caran. 1994. Birds and other wildlife of south central Texas. University of Texas Press, Austin.

Kuussaari, M., M. Nieminen, and I. Hanski. 1996. An experimental study of migration in the Glanville fritillary butterfly *Melitaea cinxia*. Journal of Animal Ecology 65: 791-801.

Laurance, W.F. 1991. Edge effects in tropical forest fragments: application of a model for the design of nature reserves. Biological Conservation 57: 205-219.

Laurance, W.F. and E. Yensen. 1991. Predicting the impacts of edge effects in fragmented habitats. Biological Conservation 55: 77-92.

Lindenmayer, D.B. and H. Possingham. 1995. Modeling the viability of metapopulations of the endangered Leadbeater's possum in south-eastern Australia. Biodiversity and Conservation 4: 964-1018.

Lovejoy, T.E., R.O. Bierregaard, A.B. Rylands, J.R. Malcolm, C.E. Quintela, L.H. Harper, K.S. Brown, A.H. Powell, G.V.N. Powell, H.O.R Schubert, and M.J. Hays. 1986. Edge and other effects of isolation on Amazon forest fragments. In: Conservation Biology: The Science and Scarcity of Diversity. M.E. Soule, ed. Sunderland, Massachusetts.

Lovejoy, T.E. and D.C. Oren. 1981. The minimum critical size of ecosystems. In: Forest island dynamics in man-dominated landscapes. R.L. Burgess and D.M. Sharpe, eds. Springer Verlag, New York.

Mader, H.J. 1984. Animal habitat isolation by roads and agricultural fields. Biological Conservation 29: 81-96.

Mader, H.J., C. Schell, and P. Kornacker. 1990. Linear barriers to arthropod movements in the landscape. Biological Conservation 54: 209-222.

Mankin, P.C. and R.E. Warner. 1997. Mammals of Illinois and the Midwest: ecological and conservation issues for human-dominated landscapes. In: Conservation in Highly Fragmented Landscapes. M.W. Schwartz, ed. Chapman and Hall, London.

May, R.M. 1975. Island biogeography and the design of wildlife preserves. Nature 254:177-178.

Meiners, S. and P. Steward. 1999. Changes in community and population responses across a forest to field gradient. Ecography 22: 261-267.

Mitchell, R.W. 1971a. Preference responses and tolerance of the troglobitic carabid beetle, *Rhadine subterranea*. International Journal of Speleology 3: 289-304.

Mitchell, R.W. 1971b. Food and feeding habits of troglobitic carabid beetle *Rhadine subterranea*. International Journal of Speleology 3: 249-270.

Musgrove, M.L. 2000. Growth rates of cave speleothems from Central Texas: Implications for Regional Paleoclimate. 11th Bathurst Meeting, Journal of Conference Abstracts, Vol 4(2).

Pape-Dawson, Inc. 2000. La Cantera Property Hydrogeologic Cave Evaluations: Helotes Hilltop cave, Helotes Blowhole, and Hills & Dales Pit. An unpublished report prepared for the La Cantera Development Company.

Pittman, B. 1999. Texas Caves. Texas A & M University Press. 122 p.

Porter, S.D., A. Bhatkar, R. Mulder, S.B. Vinson, and D.J. Clair. 1991. Distribution and density of polygyne fire ants (Hymenoptera: Formicidae) in Texas. Journal of Economic Entomology 84: 866-874.

Porter, S.D. and D.A. Savignano. 1990. Invasion of poygyne fire ants decimates native ants and disrupts arthropod community. Ecology 71: 2095-2106.

Porter, S.D., B. Van Eimeren, and L.E. Gilbert. 1988. Invasion of red-imported fire ants (Hymenoptera: Formicidae): Microgeography of competitive replacement. Annals of the Entomological Society of America 81: 913-918.

Poulson, T.L., K.H. Lavoie, and K. Helf. 1995. Long-term effects of weather on the cricket (*Hadenoecus subterraneus*, Orthoptera, Rhaphidophoridae), guano community in Mammoth Cave National Park. American Midland Naturalist 134:226-236.

Poulson, T.L. and W.B. White. 1969. The cave environment. Science 165: 971-981.

Raba-Kistner Consultants, Inc. 1993a. Geologic assessment for water pollution abatement plan, La Cantera Village, San Antonio, Texas. Unpublished report for Pape-Dawson Engineers.

Raba-Kistner Consultants, Inc. 1993b. Geologic assessment for water pollution abatement plan, La Cantera Retail Center, San Antonio, Texas. Unpublished report for Pape-Dawson Engineers.

Ranny, J.W., M.C. Bruner, and J.B. Levenson. 1981. The importance of edge in the structure and dynamics of forest islands. In: Forest Island Dynamics in Man-Dominated Landscapes. R.L. Burgess and D.M. Sharpe, eds. Springer Verlag, New York.

Reddell, J.R. 1965. A checklist of cave fauna of Texas. I. The invertebrata (exclusive of Insecta). Texas Journal of Science 17: 143-185.

Reddell, J.R. 1966. A checklist of cave fauna of Texas. II. Insecta. Texas Journal of Science 18: 25-56.

Reddell, J.R. 1967. A checklist of cave fauna of Texas. III. Vertebrata. Texas Journal of Science 19: 184-226.

Reddell, J.R. 1993. The status and range of endemic arthropods from caves in Bexar County, Texas. A report to the U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department.

Reed, R., J. Johnson-Barnard, and W.L. Baker. 1996. Fragmentation of a forested rocky mountain landscape, 1950-1993. Biological Conservation 75: 267-277.

Reeves, R.D. 1976. Chemical and bacteriological quality of water at selected sites in the San Antonio area, Texas, August 1968 - January 1975. Edwards Underground Water District Report, 122 pp.

Rice, G. 1994. Contamination of the Edwards aquifer in Bexar County. AGUA report. San Antonio, Texas. 25pp.

Roddy, W.R. 1992. Water quality of the Edwards Aquifer and streams recharging the aquifer in the San Antonio region, Texas. U.S. Geological Survey, Hydrologic Investigations Atlas HA-723, 3 sheets.

Rosatte, R.C., M.J. Powers, and C.D. MacInnes. 1991. Ecology of urban skunks, raccoons, and foxes in Metropolitan Toronto. In: Wildlife Conservation in Metropolitan Environments. L.W. Adams and D.L. Leedy, eds. National Institute for Urban Wildlife Symposium Series 2. National Institute for Urban Wildlife Symposium Series 2. National Institute for Urban Wildlife. Columbia, Maryland.

Russell, W. 1987. Edwards stratigraphy and oil spills in the Austin, Texas area. Pages 27-31 In: The Texas Caver. Austin, Texas.

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1990. Biological consequences of ecosystem fragmentation: a review. Conservation Biology 5: 18-32.

Shirer, H. and H. Fitch. 1970. Comparison from radiotracking of movements and denning habits of the raccoon, stripped skunk, and opossum in northeastern Kansas. Journal of Mammalogy 51: 491-503.

Smith, R.L. 1990. Ecology and Field Biology, 4th ed. Harper Collins Publishers, Inc., New York.

Soil Conservation Service. 1962. Soil Survey of Bexar County, Texas. U.S. Department of Agriculture. Texas Agriculture Experiment Station.

Stefan, R. and P. Fairweather. 1997. Changes in florestic composition of urban bushland by *Pittsporum undulation* in northern Sydney, Australia. Australian Journal of Botany 45: 123-149.

Stein, W.G. and G.B. Ozuna. 1995. Geologic framework and hydrogeologic characteristics of the Edwards Aquifer recharge zone, Bexar County, Texas. U.S. Geological Survey: Water-Resources Investigations 95-4030.

Suarez, A.V., D.T. Bolger, and T.J. Case. 1998. Effects of fragmentation and invasions on native ant communities in coastal Southern California. Ecology 79: 2041-2056.

SWCA, Inc. 2000a. Results of karst terrain features investigations of the La Cantera property northern Bexar County, Texas. An unpublished report prepared for the La Cantera Development Company.

SWCA, Inc. 2000b. Hydrogeologic assessment of three caves within the proposed Canyon Ranch cave preserve. An unpublished report prepared for the La Cantera Development Company.

Thompson, J.N. 1985. Within -patch dynamics of life histories, populations, and interactions: selection over time in small spaces. In: The Ecology of Natural Disturbances and Patch Dynamics. S.T.A. Pickett and P.S. White, eds. Academic Press, Inc., Orlando.

Tscharntke, T. 1992. Fragmentation of Phragmites Habitats, Minimum Viable Population Size, Habitat Suitability, and Local Extinction of Moths, Midges, Flies, Aphids, and Birds. Conservation Biology 6(4): 530-536.

Turner, I. 1996. Species loss in fragments of tropical rain forest: A review of the evidence. Journal of Applied Ecology 33: 200-209.

U.S. Army Corps of Engineers. 1987. Corps of Engineers Wetlands Delineation Manual. Washington, D.C.

U.S. Fish and Wildlife Service. 2000. Endangered and threatened wildlife and plants; final rule to list nine Bexar County, Texas invertebrate species as endangered .

Veni and Associates. 1994. Geologic controls on cave development and the distribution of endemic cave fauna in the San Antonio, Texas, Region. Prepared for Texas Parks and Wildlife Department and the US Fish and Wildlife Service.

Veni and Associates. 1988. Hydrogeologic investigation of the Jollyville Plateau karst, Travis County, Texas. Report prepared for Parke Investors Ltd., 620 Investors Ltd., and U.S. Fish and Wildlife Service.

Veni, G. and J. R. Reddell. 1999. Management plan for the conservation of rare karst species and karst species proposed for endangered listing, Camp Bullis, Bexar and Comal counties, Texas. Report for Garrison Public Works, Environmental Division, Fort Sam Houston, Texas, 143 pp.

Vinson, S.B. and A.A. Sorensen. 1986. Imported fire ants: life history and impact. Texas Department of Agriculture and Texas A&M University.

Wigley, T. and T. Roberts. 1997. Landscape-level effects of forest management on faunal diversity in bottomland hardwoods. Forest Ecology and Management 90: 141-154.

Wilcove, D., C. McLellan, and A. Dobson. 1986. Habitat fragmentation in the temperate zone. In: Conservation Biology: The Science of Scarcity and Diversity. M.E. Soule, ed. Sinauer Associates, Inc. Sunderland, Massachusetts.

Yahner, R.H. 1988. Changes in Wildlife Communities Near Edges. Conservation Biology 2: 333-339.

Appendix I - Applicant's Assessment of La Cantera Cave Biota and HCP Preserve Descriptions.

by

SWCA, Inc., Environmental Consultants

TABLE OF CONTENTS

List of Tables

List of Figures

1.0 INTRODUCTION

This appendix provides an assessment of La Cantera Caves #1, #2, and #3, including details of previous biota collecting events, hydrogeologic assessments, cave maps, surface drainage areas, a description of the preserves established for Caves #1 and #2 and other relevant information. The appendix also describes available information of the five off-site mitigation preserves and delineates their boundaries.

The off-site mitigation preserves contain a total of eight caves on approximately 179 acres, including the type locations and several additional populations of *Rhadine exilis* and *Rhadine infernalis,* the type location and a new location for the Helotes mold beetle (*Batrisodes venyivi*), the type location, two confirmed locations, and two assigned locations for Madla's cave meshweaver (*Cicurina madla*), and four caves containing populations which may belong to the Cokendolpher cave harvestman (*Texella cokendolpheri*). In addition, two of the mitigation caves contains a significant species of concern, a troglobitic spider of the genus *Neoleptoneta*, which is closely related to the endangered Government Canyon Bat Cave spider (*Neoleptoneta microps*) (See Table AII-1).

This appendix describes each preserve and cave and provides information necessary to establish the long-term viability of the preserves (See also Table AII-1). Each section of this appendix discusses the associated preserve and includes maps depicting the boundaries, topography, cave locations, and current vegetation coverage; a table of all biota identified within each cave; and a description and map of each cave. Hydrogeologic assessments have been conducted on each preserve to delineate the subsurface and surface drainage basins of each cave within the preserve. The full hydrogeologic assessment reports are also included.

Table AII-1. Mitigation Preserve Summary.

Mitigation Preserves	Approximate Preserve Acreage	Gated Yes / No	Hydro-geologic Evaluation Yes/No	Current Surrounding Land Use	Karst Faunal Region	Preserve Quality Expected After Development	*Rhadine exilis*	*Rhadine infernalis*	*Cicurina madla*	*Batrisodes venyivi*	*Texella cokendolpheri*
La Cantera Cave #1 Preserve	1	Yes	Yes	Close proximity to Loop 1604	UTSA	Low	x[2]		x[3]		
La Cantera Cave #2 Preserve	1	Yes	Yes	Close proximity to Loop 1604	UTSA	Low	x[2]		x[3]		
John Wagner Ranch Cave #3 Preserve	4	No	Yes	Undeveloped and light residential development.	UTSA	High[1]	x[2]	x[2]	x[3]		x[3]
Hills and Dales Pit Preserve	70	Yes	Yes	Undeveloped and light residential development.	UTSA	High*	x[2]		x[2]		x[3]
Helotes Hilltop/ Helotes Blowhole Cave Preserve	25	No	Underway	Undeveloped and light residential development.	Helotes	High*	x[2]	x[2]	x[2]	x[2]	
Madla's Cave Preserve	5	No	Yes	Undeveloped / Government Canyon SNA	Helotes	High[1]		x[2]	x[2]		
Canyon Ranch Preserve	75	No	Underway	Undeveloped / Government Canyon SNA	Govern-ment Canyon	High*		x[2]	x[2]	x[2]	x[3]

[1] While La Cantera was unable to purchase additional land to the north of John Wagner Ranch Cave #3 and Madla's Cave, several hundred acres around both caves will be available in the future to expand these preserves under additional conservation actions.

[2] Confirmed taxonomic classification

[3] Unconfirmed taxonomic classification

* These preserves are of adequate size to protect the karst invertebrates regardless of the level of development of adjacent properties.

2.0 LA CANTERA PRESERVES (CAVES #1 AND #2)

The La Cantera caves (See Figure 1) are vertically-oriented vadose shafts which evolved to rapidly transmit recharging precipitation to the water table under cooler, wetter paleoclimatic conditions. The landscape under which they originally evolved has long-since been eroded away and they remain as truncated conduits which still function as recharge features transmitting less water, less frequently than in the past. Accordingly, the caves have few horizontal surfaces relative to the total volume of passage and those surfaces tend to get scoured or submerged during recharge events. With few horizontal surfaces where organic material can accumulate, habitat for springtails and other detritovores which, in part, constitute the base of the troglobitic food chain, is limited. Shelter areas for cave crickets are also limited. The vertical nature of passages also makes habitation by small mammals fairly difficult. Consequently, it appears that the quality of terrestrial karst invertebrate habitat in the La Cantera caves varies temporally and is, in general, poorer than caves with more laterally extensive passage which is sheltered from scouring and those with more suitable habitat for small mammals and crickets.

The biota of the la Cantera caves have been studied since 1994. In total, La Cantera Cave #1 has been surveyed nine times, Cave #2 has been surveyed seven times, and Cave #3 has been surveyed six times. Individual counts of fauna observed in the La Cantera caves have been low relative to other caves. This is especially true of La Cantera Cave #3 which was closed to the surface prior to excavation by SWCA, Inc. (SWCA) and therefore deprived of a regular nutrient source. Given this condition, it is important to note that the caves proposed for mitigation are of a much higher quality (density and diversity of species) than the caves on the Property which may be impacted by development.

Climate record data for the 1994, 1995, and 2000 biological surveys included in Figures 2, 3, and 4 confirm that most of the biota surveys occurred during climatic conditions conducive to encountering karst invertebrates in the La Cantera caves. According to current draft protocols, periods of drought, abnormally high precipitation, and temperature extremes may reduce the likelihood of encountering terrestrial karst invertebrates in humanly accessible cave areas and may therefore be inappropriate times to conduct biological surveys. Although extreme weather conditions certainly decrease the likelihood of encountering karst invertebrates in shallow caves that are well connected to the surface, this effect is increasingly buffered with depth, especially in caves with small aperture entrances such as the La Cantera caves.

Hourly temperature and humidity data were gathered in all three caves between 22 May and 1 August 1999 using Stowaway loggers manufactured by Onset Computer Corporation. The temperature loggers are accurate to 0.2 degrees Celsius and the humidity loggers are accurate within 5% relative humidity. Temperature and relative humidity data collected in all three caves show that internal conditions in the vicinity of the primary karst invertebrate habitat areas are remarkably constant.

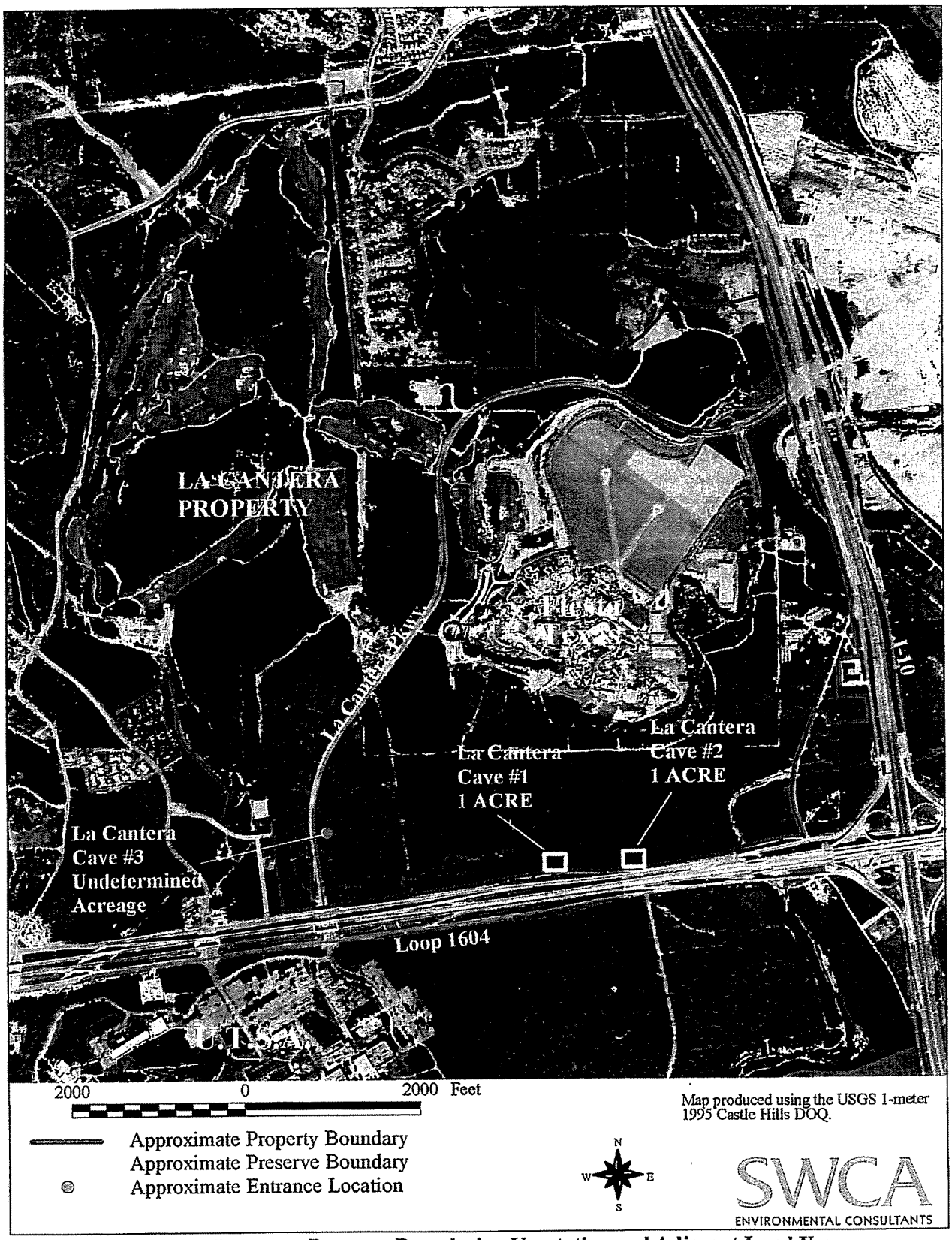


Figure 1. La Cantera Property, Preserve Boundaries, Vegetation and Adjacent Land Use.

2.1 La Cantera Cave #1

La Cantera Cave #1 is a fracture-oriented vadose shaft formed in the Leached and Collapsed Member of the Person Formation of the Edwards Group limestone. It evolved to rapidly transmit meteoric water to the phreatic zone of the aquifer along a near-vertical to vertical hydraulic gradient. Open cave passage descends to a total depth of approximately 40 vertical feet from a 3-foot-diameter entrance in a solution sinkhole. A crawl way at the base of the lowest room is open for 4 feet before becoming impassable. Figure 5 is a map of La Cantera Cave #1 in profile and plan view. The map has been modified to include the division of passages into three photic zones. Zone 1 is the light zone which consists of the entrance shaft and portions of the cricket room near the entrance shaft. Zone 2 is the twilight zone which consists of most of the cricket room. The twilight zone represents the interface between the light and permanently dark areas of the cave. Zone 3 is the dark zone which consists of all cave passage beyond the reach of reflected and refracted light from the entrance shaft. Troglobitic species were almost exclusively encountered in zone 3 but occasionally encountered in zone 2. Trogloxene species were encountered in zones 2 and 3 and occasionally in zone 1. Karst invertebrate habitat quality is highest at the bottom of the cave (See Figure 5).

Biological surveys of La Cantera Cave #1 were conducted by SWCA personnel including Dr. Kenneth Kingsley and Andy Grubbs on 21 and 29 April 1994, 23 May, 23 August, 4 and 26 September, and 2 October 1995. On 26 September 1995 an inventory of all fauna observed was made. During those surveys La Cantera Cave #1 yielded specimens of the now listed species *Rhadine exilis* and an eyeless troglobitic spider of the genus *Cicurina*. In an attempt to acquire adult *Cicurina* specimens which would allow for a species-level determination, additional biota collections were conducted by SWCA personnel including Kemble White, Hub Bechtol, and Dr. Steven Carothers on 23 May, 26 July, and 13 and 20 August 2000. In addition to preserved specimens, live specimens were captured during these studies to be reared to adulthood. Both preserved and live specimens were delivered to James Cokendolpher for identification. Of more than 40 eyeless specimens collected, none were adult. All specimens collected, including three live specimens, remain in the care of Mr. Cokendolpher. The live specimens may be identifiable to species level if they survive to adulthood. Based on the best scientific information available, the eyeless specimens most likely belong to *C. madla.*

Where possible, biological survey data have been broken up according to survey date on Table AII-2; however, data for the 1994 and 1995 surveys are only available as a single list of all species known from the cave. Those data are presented along with the number of individuals encountered during a survey on 26 September 1995 when a population estimate was made. Field notes for each individual survey date were kept by personnel who are no longer employed by SWCA, and are unavailable.

Temperature data within La Cantera Cave #1 were remarkably constant at 20.75 °C (69.35°F) during the entire data logging period. Relative humidity reached 100% within a few days of data logger installation and remained there for the duration of the logging period. This was coincident with the onset and duration of the rainy season. During the 23 May and 26 July 2000 biota surveys, temperature and relative humidity data were collected using a hand-held Hanna Instruments HI93640 digital thermohygrometer. Those data are given in Table AII-3.

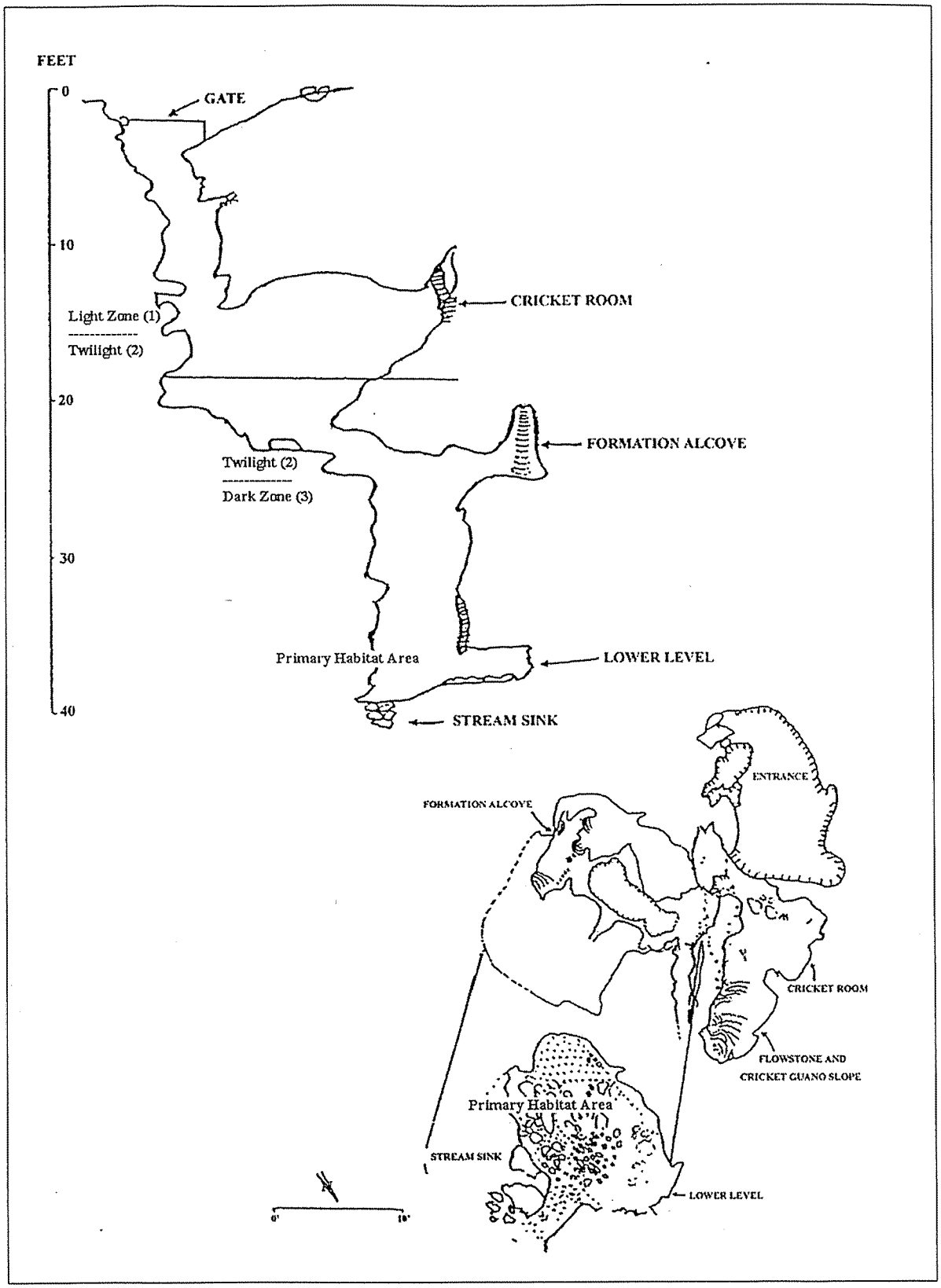


Figure 5. Profile and Plan Map of La Cantera #1.

Table AII-2. Biota of La Cantera Cave #1.

Taxa present	Common Name	Number observed on 9/26/95	5/23/00	7/26/00	8/13/00	8/20/00
Rhadine howdeni	beetle	0	2	0	1	1
Rhadine exilis	beetle					
Staphylinidae (rove beetles), genus not determined	rove beetle	11	4	0	9	3
Mixojapyx sp.	japygid	1	0	0	0	0
Texoreddellia texensis	silverfish	65	10's	10's	10's	10's
Ceuthophilus sp.	cricket	1272	100's	100's	100's	100's
Diptera, families not determined	flies	not counted	10's	10's	10's	10's
Pseudosinella violenta	springtail	not counted	100's	100's	100's	100's
Cicurina varians	spider	80	10's	10's	10's	10's
Cicurina species, probably *C. madla*	blind spider, possibly an endangered species	0	10's	10's	10's	10's
Hoplobunus madlae	harvestman	1	2	3	4	1
Leiobunum sp	daddy-long-legs	103	100's	100's	100's	100's
Brackenridgia sp.	woodlouse	70	10's	10's	10's	10's
Solenopsis invicta	fire ants	31	<10	10's	<10	<10

Table AII-3. Temperature and Relative Humidity Data Collected in La Cantera Cave #1.

Date	Time	Cave	Location	Temperature (°F)	Relative Humidity (%)
23 May 2000	12:10pm	La Cantera #1	Cricket Room	83.3	67.4
23 May 2000	12:37pm	La Cantera #1	Bottom of main pit	77.6	72.5
26 July 2000	2:10pm	La Cantera #1	Surface	99.4 in shade	42.2
26 July 2000	2:26pm	La Cantera #1	Cricket Room	84.7	52.8
26 July 2000	2:51pm	La Cantera #1	Bottom of main pit	77.9	63.3
26 July 2000	3:17pm	La Cantera #1	Side Passage off of main pit	76.3	82.9

Red imported fire ants have been seasonally observed in the area of La Cantera Cave #1. The entrance is currently gated and enclosed by a fenced preserve which will be expanded to encompass one acre.

2.2 La Cantera Cave #2

La Cantera Cave #2 is a fracture-oriented vadose shaft formed in the Leached and Collapsed Member of the Person Formation of the Edwards Group limestone. It evolved to rapidly transmit meteoric water to the phreatic zone of the aquifer along a near-vertical to vertical hydraulic gradient. La Cantera Cave #2 descends through a series of shafts to an approximate depth of 115 vertical feet from a 3-foot-diameter solution sinkhole entrance. Figure 6 is a map of La Cantera Cave #2 in profile and plan view. The map has been modified to include the division of passages into three photic zones. Zone 1 is the light zone which consists of the entrance crawl. Zone 2 is the twilight zone which consists of most of the cricket room. The twilight zone represents the interface between the light and permanently dark areas of the cave. Zone 3 is the dark zone which consists of all cave passage beyond the reach of reflected and refracted light from the entrance crawl. Troglobitic species were almost exclusively encountered in zone 3 but occasionally encountered in zone 2. Trogloxene species were encountered in zones 2 and 3 and occasionally in zone 1. Karst invertebrate habitat quality is highest along a series of drops below the cricket room at depths roughly between 25 and 40 feet below the surface, and at the bottom of the cave on surfaces between roughly 105 and 110 feet (See Figure 6).

Biota collections were conducted on 21 and 29 April 1994, 23 May 1995, 23 August 1995, 4 and 26 September 1995, and 2 October 1995 by SWCA personnel including Dr. Kenneth Kingsley and Andy Grubbs. On 26 September 1995, a count was made of all animals seen. During those surveys La Cantera Cave #2 yielded specimens of the now listed species *Rhadine exilis* and an eyeless troglobitic spider of the genus *Cicurina*.

Data for the 1994 and 1995 surveys of La Cantera Cave #2 are only available as a single list of all species known from the cave. Those data are presented in Table AII-4 along with the number of individuals encountered during a survey on 26 September 1995 when a population estimate was made. Field notes for each individual survey date were kept by personnel who are no longer employed by SWCA, and are unavailable.

Hourly temperature and humidity data were gathered in La Cantera Cave #2 between 22 May and 1 August 1999 using Stowaway loggers manufactured by Onset Computer Corporation. The temperature loggers are accurate to 0.2 degrees Celsius and the humidity loggers are accurate within 5% relative humidity. Temperature within La Cantera Cave #2 was relatively constant beginning at 19.6 °C (67.28°F) on 22 May, rising to 19.8 °C (67.64°F) by 1 July, and rising to 19.96 °C (67.86°F) by 25 July. La Cantera Cave #2 was the coolest of the three La Cantera caves. As with La Cantera Cave #1, relative humidity reached 100% within a few days of data logger installation and remained there for the duration of the logging period. This was coincident with the onset and duration of the rainy season.

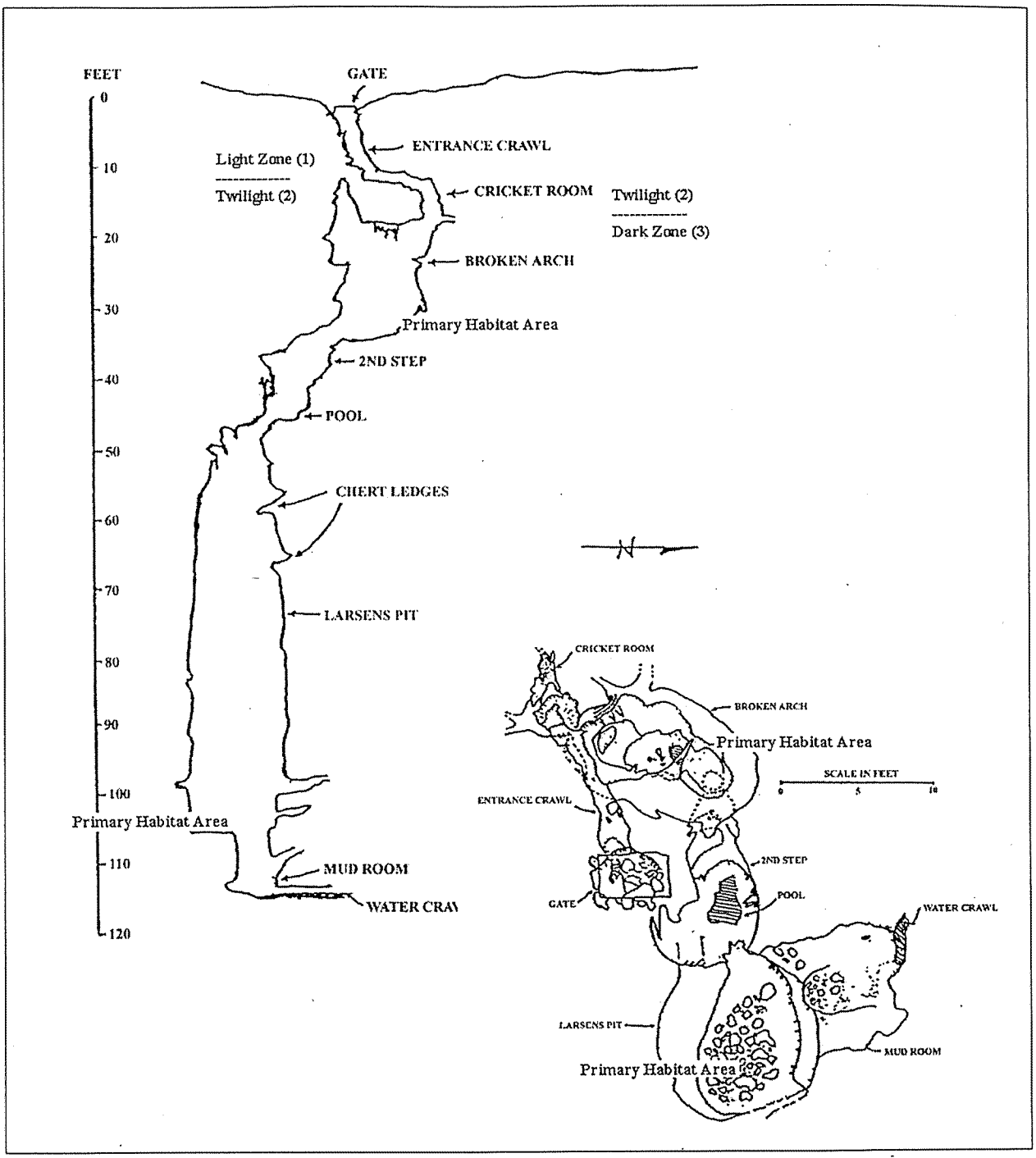


Figure 6. Profile and Plan Map of La Cantera #2.

Table AII-4. Biota of La Cantera Cave #2.

Taxa present	Common Name	Number observed on 9/26/95
Rhadine exilis	beetle, endangered species	0
Rhadine howdeni	beetle	0
Staphylinidae (rove beetles), genus not determined	rove beetle	20
Mixojapyx sp.	japygid	1
Texoreddellia texensis	silverfish	58
Ceuthophilus sp.	cricket	161
Diptera, families not determined	flies	not counted
Pseudosinella violenta	springtail	not counted
Cicurina varians	spider	2
Cicurina sp.	blind spider, possibly a listed species	0
Hoplobunus madlae	harvestman	1
Leiobunum sp.	daddy-long-legs	not counted
Cambala speobia	cave millipede	13
Brackenridgia sp.	woodlouse	110
Stygobromus russelli	cave amphipod	not counted

2.3 La Cantera Cave #3

La Cantera Cave #3 is a vadose shaft formed in the Leached and Collapsed Member of the Person Formation of the Edwards Group limestone. Prior to excavation by SWCA in 1994, the entrance had been plugged with limestone breakdown and clay soil. As a result, very little organic debris exists in the cave. Open cave passage descends vertically with almost no lateral development to an approximate depth of 68 vertical feet from a 2-foot-diameter sinkhole entrance. Figure 7 is a map of La Cantera Cave #3 in profile and plan view. The map has been modified to include the division of passages into three photic zones. Zone 1 is the light zone which consists of the entrance shaft and portions of the cricket room near the entrance shaft. Zone 2 is the twilight zone which consists of most of the cricket room. The twilight zone represents the interface between the light and permanently dark areas of the cave. Zone 3 is the dark zone which consists of all cave passage beyond the reach of reflected and refracted light from the entrance shaft. Troglobitic species were almost exclusively encountered in zone 3 but occasionally encountered in zone 2. Trogloxene species were encountered in zones 2 and 3 and occasionally in zone 1.

The most suitable karst invertebrate habitat occurs in a small room at the bottom of the first drop at a depth of approximately 30 feet where minimal lateral development provides horizontal surfaces where organic debris from the surface can accumulate (See Figure 7). This room measures roughly ten feet by eight feet with a few bedding plane partings extending into the walls for an additional two to four feet. Relatively small populations of springtails and cave crickets are the most abundant biota observed. The main shaft continues from the southeast wall of this room. Beyond this point the cave is almost entirely devoid of organic material. Only a few individual isopods, silverfish and millipedes have been observed below. Most of these observations were made after rains indicating that they may have been washed down the main shaft from the room above. The floor of the main shaft is located at an elevation of approximately 58 feet below the surface and is composed of a plug of terra-rossa clay with limestone and chert fragments. Minor amounts of possible paleontological materials such as small mammal bones occur in the clay matrix. An 8-inch diameter conduit penetrates the plug draining the shaft.

Biological surveys of La Cantera Cave #3 were conducted by SWCA personnel including Dr. Kenneth Kingsley and Andy Grubbs on 13 June 1994, 23 May and 2 October, 1995. Additional biota surveys of the cave were conducted by SWCA on 13 September 2000, by SWCA and Horizon ESI on 20 September 2000, and by SWCA on 16 November 2000. Biological activity was generally lower during those surveys and no new species were encountered. All of the species accurately reported during the previous surveys were observed during the 2000 surveys. All species encountered in the cave during those surveys are included in Table AII-5. The 2000 surveys of La Cantera Cave #3 yielded two live specimens and one preserved specimen of an eyeless troglobitic spider of the genus *Cicurina*. The live specimens are in the care of James Cokendolpher and may be identifiable to species level if they survive to adulthood. Temperature and humidity data gathered during those surveys are given in Table AII-6.

Hourly temperature and humidity data were gathered in La Cantera Cave #3 using Stowaway loggers manufactured by Onset Computer Corporation between 22 May and 1 August 1999. The temperature loggers were accurate to 0.2 degrees Celsius and the humidity loggers were accurate

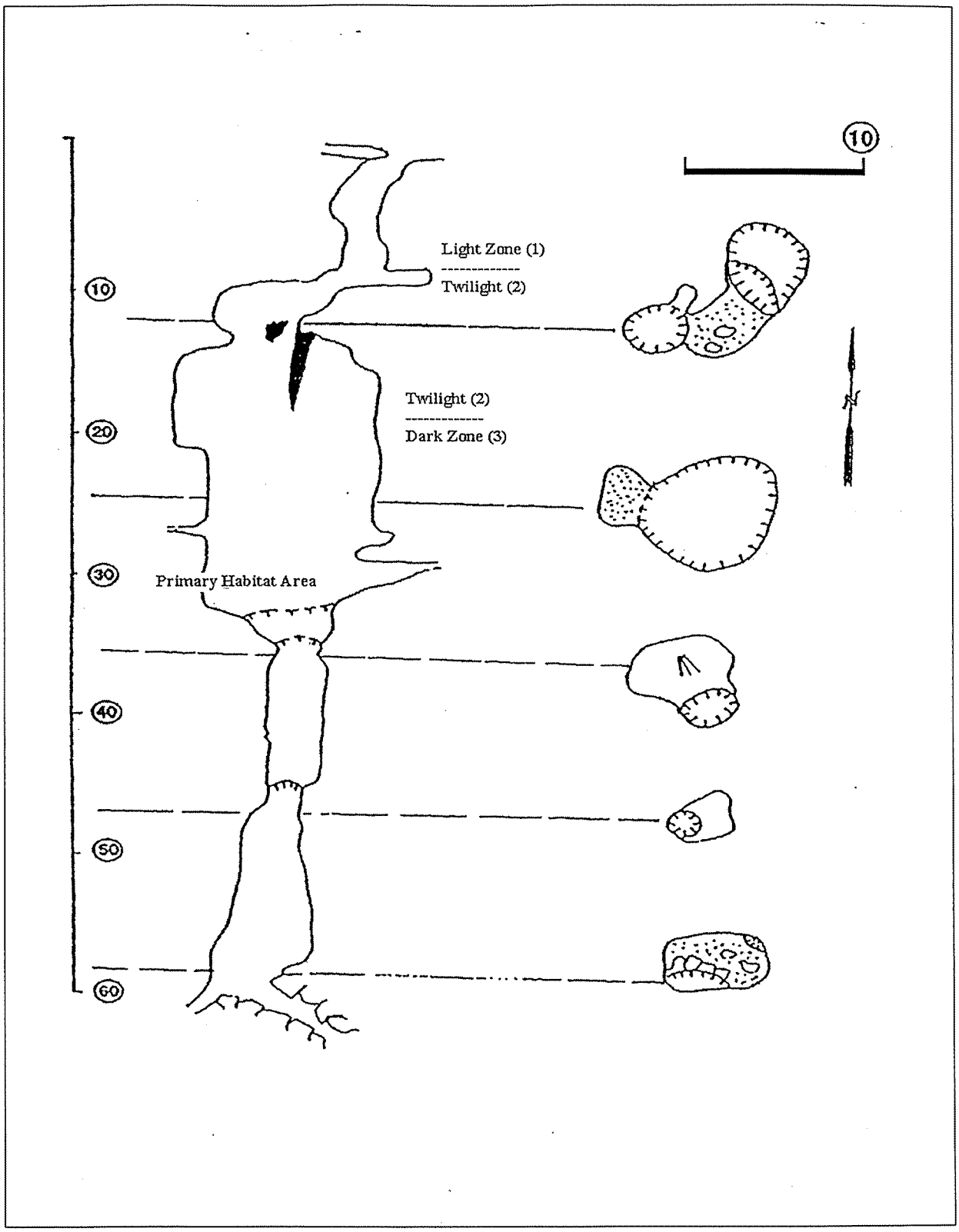


Figure 7. Profile and Plan Map of La Cantera #3.

Table AII-5. Biota of La Cantera Cave #3.

"x" indicates an observation, numerals indicate an observation and population estimate.

Taxon encountered	Common Name	Observed during 1994-95 surveys	Observed 9/13/00	Observed 9/20/00	Observed 11/16/00
Rhadine howdeni	beetle	x	1	1	
Batrisodes uncicornis	mold beetle	x	1		
Texoreddellia texensis	silverfish	x	10's	10's	10's
Ceuthophilus sp.	Cave cricket	x	100's	10's	10's
Pseudosinella violenta	springtail	x	100's	10's	100's
Cicurina varians	spider	x	10's	<10	10's
Cicurina sp.	blind spider, possibly an endangered species	x	3		2
Lieobunum sp.	daddy longlegs	x	100's	10's	10's
Cambala speobia	Cave millipede	x	10's	10's	10's
Speodesmus sp.	Cave millipede	x	<10	<10	<10
Brackenridgia sp.	woodlouse	x	10's	10's	10's
Solenopsis invicta	red imported fire ant		<10	<10	<10
Bufo sp.	Toad				1

Table AII-6. Temperature and Relative Humidity Data Collected in La Cantera Cave #3.

Date	Time	Cave	Location	Temperature (°F)	Relative Humidity (%)
13 Sept 2000	12:10pm	La Cantera #3	Surface	96.8	42.9
13 Sept 2000	12:37pm	La Cantera #3	Bottom of first drop	81.4	74.2
13 Sept 2000	1:10pm	La Cantera #3	Bottom of main pit	76.5	83.3
20 Sept 2000	2:26pm	La Cantera #3	Surface	95.6	43.1
20 Sept 2000	2:51pm	La Cantera #3	Bottom of first drop	82.7	73.5
20 Sept 2000	3:17pm	La Cantera #3	Bottom of main pit	76.3	82.9
16 Nov 2000	11:31am	La Cantera #3	Surface	76.8	70.5
16 Nov 2000	11:53am	La Cantera #3	Bottom of first drop	73.1	85.8
16 Nov 2000	12:28pm	La Cantera #3	Bottom of main pit	73.8	95.7

within 5% relative humidity. A logger malfunction in Cave #3 resulted in the loss of relative humidity data for the period 12 June through 1 August 1995. Temperature within La Cantera Cave #1 was relatively constant beginning at 20.42°C (68.75°F) on 22 May, rising to and stabilizing at 20.60°C (69.08°F) by 17 June, and rising to 20.85 °C (69.53°F) by 29 July. As with La Cantera Caves #1 and #2, relative humidity reached 100% within a few days of data logger installation and remained there for the duration of the logging period. This was coincident with the onset and duration of a relatively rainy season.

Red imported fire ants have been seasonally observed in the area of La Cantera Cave #3 during past surveys, a large active mound was observed between the cave entrance and La Cantera Parkway during the 16 November 2000 survey.

3.0 JOHN WAGNER RANCH CAVE #3 PRESERVE

John Wagner Ranch Cave #3 is located on a hillside approximately one half mile east of Scenic Loop Road just north of Wagner Road. Figure 8 is an aerial photo indicating the vegetative cover, adjacent land use, and location of the cave entrance. Total acreage for the John Wagner Ranch Cave #3 Preserve is approximately 4 acres and is surrounded by light residential development consisting of single family homes on lots averaging roughly 5 acres. Figure 9 is a topographic map of the area surrounding John Wagner Ranch Cave #3. Vegetation consists of short semi-open Ashe juniper (*Juniperus ashei*)/ live oak (*Quercus virginiana*) woodland. Underlying geology consists of the upper Glen Rose Formation. The subject property is located within the Edwards Aquifer Contributing Zone in the UTSA karst faunal area[4].

The majority of the cave consists of a large entrance room formed in a 45-foot-diameter collapse sinkhole with ceiling heights ranging from 6 to 15 feet. A series of interconnected passages extend 66 feet to the northeast. Figure 10 is a map of John Wagner Ranch Cave #3. Most of the water entering the cave comes through the entrance as sheet flow during rainfall events. A hydrogeological evaluation of the preserve area was conducted by Veni[5]. The delineation of surface and sub-surface drainage is discussed in Section 8.0. The surface drainage area includes a steeply sloping hillside to the north with an estimated area of 0.41 acres. It is entirely enclosed by the preserve boundaries. The preserve encompasses more than 60 percent of the potential subsurface drainage area as delineated by Veni. The remaining approximately 40 percent of the potential subsurface drainage area is located on adjacent undeveloped property. As can be see from aerial photography (Figure 8) significant adjacent undeveloped acreage remains intact. Repeated attempts by the La Cantera Endangered Species Compliance Committee to persuade the owners of the only large neighboring tract to sell their holdings have failed. Notification by USFWS of neighboring landowners of their responsibilities under the Federal ESA should curtail further encroachment on the potential preserve area.

Biological collections and lists of fauna for John Wagner Ranch Cave #3 have been documented since 1962[6]. Biota data were gathered from Veni (1988), Reddell (1997), and Reddell (1993) and are given in Table AII-7. Protection of John Wagner Ranch Cave #3 will achieve the conservation of at least ten troglobitic species including at least two, and as many as five endangered species. The cave is known to contain *Rhadine exilis* (Type location), and *Rhadine infernalis.* It also contains blind troglobitic spiders of the genus *Cicurina* which may belong to *C. madla*, and a new species of cave spider of the genus *Neoleptoneta.* A sample preliminarily assigned to *Texella cokendolpheri* was collected from this cave by Scott Harden of the Texas Memorial Museum in 1985[7]. If the *Texella* population within John Wagner Ranch Cave #3 is *T. cokendolpheri* it could possibly be the only known surviving population as *T. cokendolpheri* has not been collected from its type location, Robber Barron Cave, for many years.

---

[4]As delineated in Geologic Controls on Cave Development and the Distribution of Endemic Cave Fauna in the San Antonio, Texas, Region. Veni, 1994.

[5]Evaluation of Areas of Potential Influence on Karst Ecosystems for Certain Caves in Bexar County, Texas (part 1 of 2) revised 4 October 1996.

[6]Veni, Caves of Bexar County 2nd Edition, 1988.

[7]Ubick, D. and Briggs, T.S. The Harvestman Family Phalangodidae. 3. Revision of Texella Goodnight and Goodnight (Opiliones: Laniatores). Texas Memorial Museum, Speleological Monograph 3:155-240.

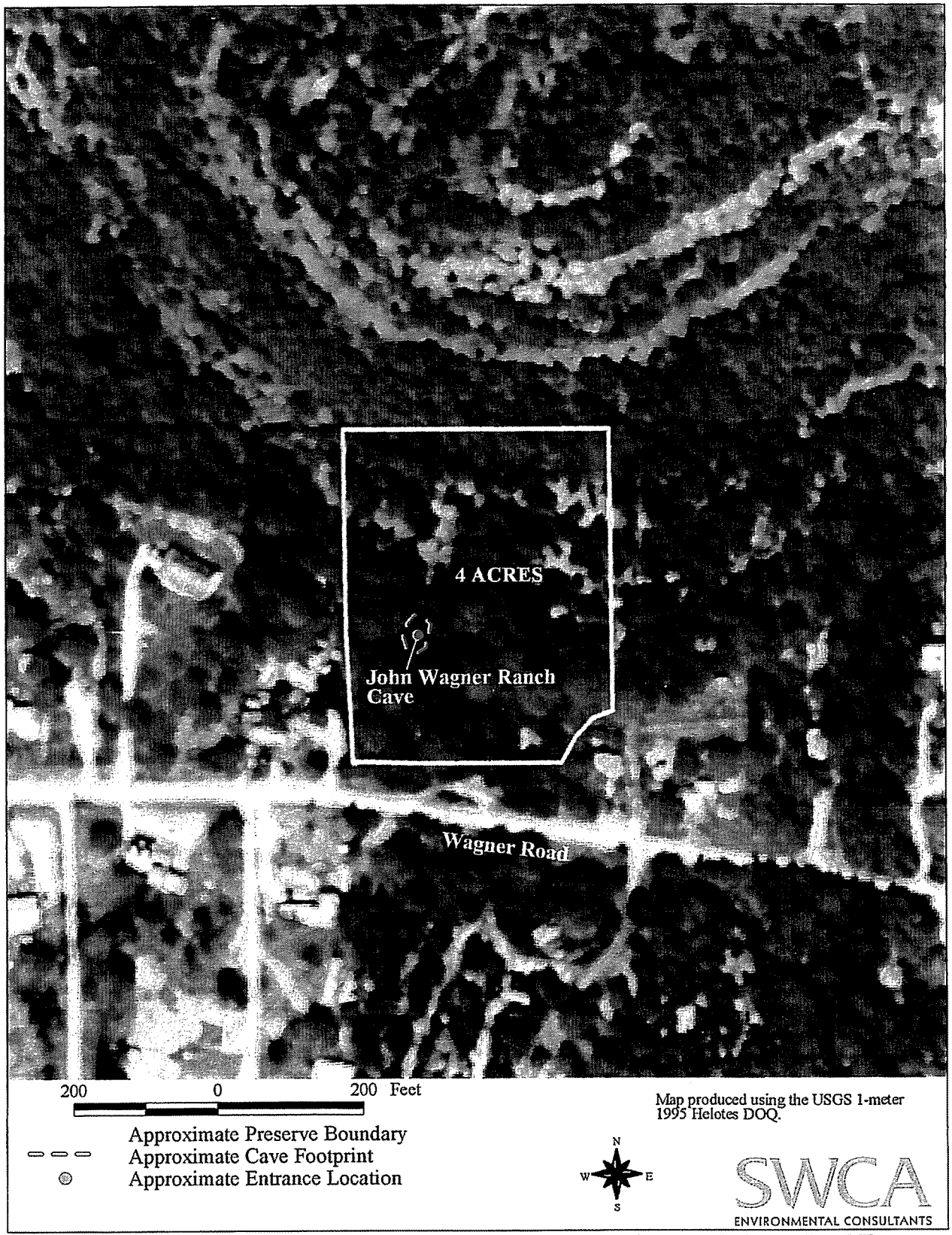


Figure 8. John Wagner Ranch Cave #3 Preserve Boundary, Vegetation, and Adjacent Land Use.

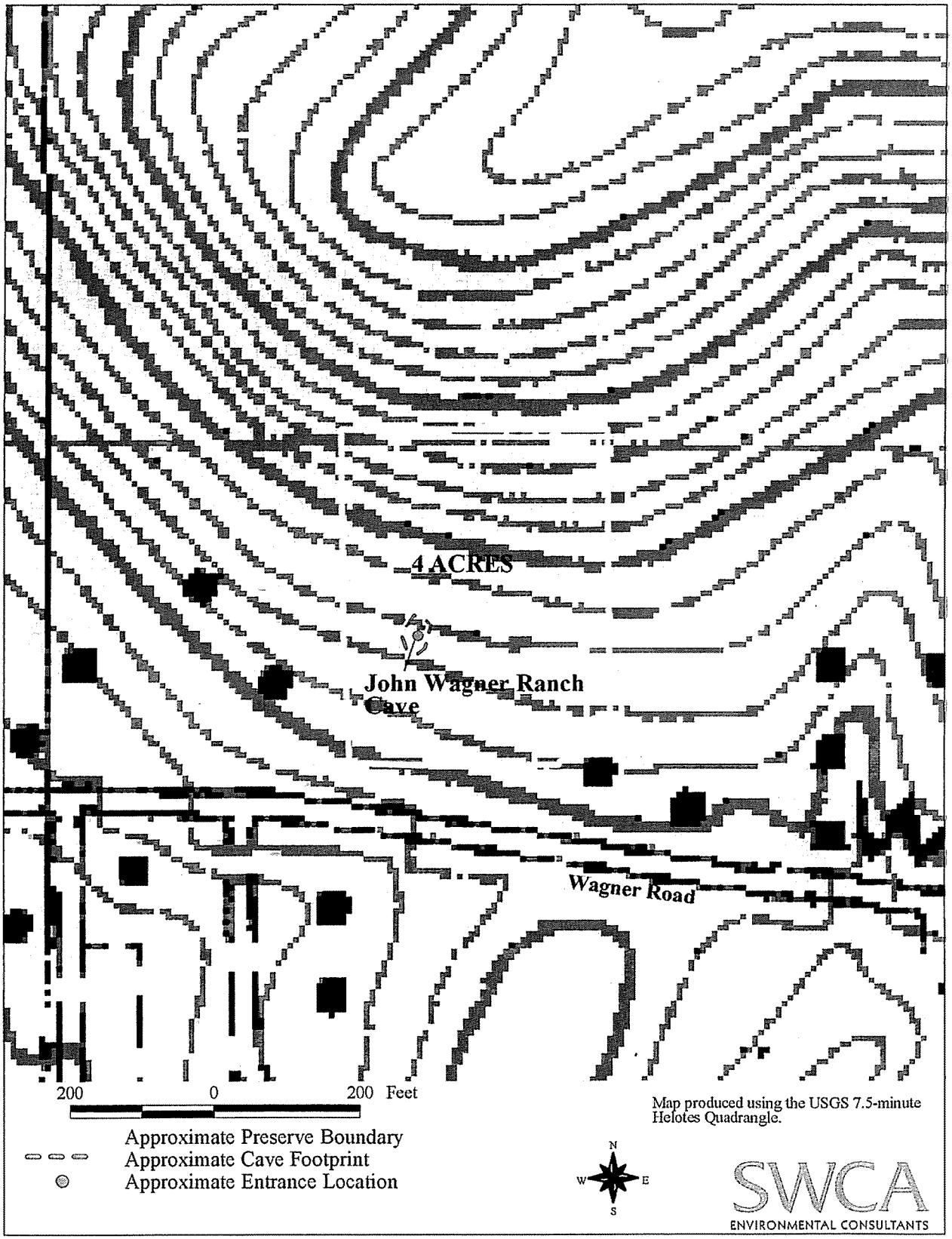


Figure 9. Topographic Map Showing John Wagner Ranch Cave #3 Preserve Boundary, Vegetation, and Adjacent Land Use.

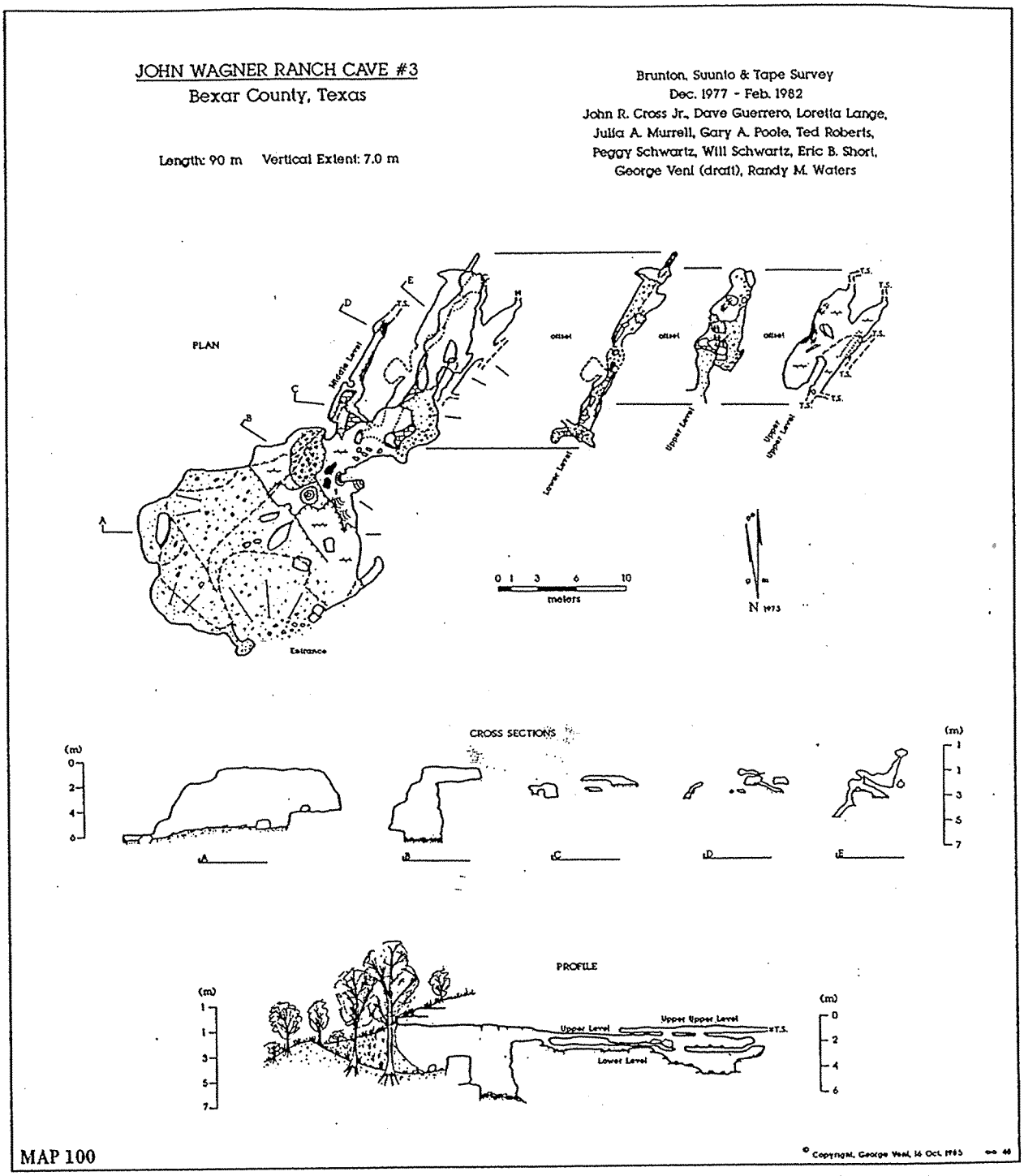


Figure 10. Wagner Ranch Cave #3 Cave Map. Reprinted with author's permission from Veni, G., 1988, The Caves of Bexar County: 2nd Edition. Texas Memorial Museum Speleological Monograph, 2. p. 170.

Table AII-7. Biota of John Wagner Ranch Cave.

Taxon encountered	Common Name
Alleculidae	comb-clawed beetle
Belonuchus sp.	rove beetle
Brackenridgia cavernarum	troglobitic isopod
Cambala speobia	troglobitic millipede
Ceuthophilus new *sp.*	cave cricket
Ceuthophilus cunicularis	cave cricket
Ceuthophilus secretus	cave cricket
Cicurina sp. (eyeless), *possibly C. madla*	Eyeless troglobitic spider, possible endangered species
Culicidae	mosquito
Diptera	fly
Helicodiscus eigenmannii	snail
Hoplobunus madla	troglobitic harvestman
Leptogenys elongata	ant
Leiobunum townsendii	daddy longlegs
Metoponorthus sp.	isopod
Neoleptoneta new *sp.*	troglobitic spider
Orus (Leucorus) rubens	rove beetle
Plethodon glutinosus albagula	slimy salamander
Psocoptera sp.	bark lice
Rhadine exilis	troglobitic ground beetle, endangered species
Rhadine infernalis	troglobitic ground beetle, endangered species
Speodesmus sp.	troglobitic millipede
Vaejovis reddelli	troglobitic scorpion

4.0 HILLS AND DALES PIT PRESERVE

Hills and Dales Pit is located approximately one half mile north of Loop 1604 Road west of Babcock Road in the Hills and Dales community in northern Bexar County, Texas. Figure 11 is an aerial photo indicating the vegetative cover, surrounding land use, and location of the cave entrance. During the 1980's some vegetation was cleared on the western side of the preserve area in preparation for residential road construction. That development was halted and no further land alteration activities have occurred on the property since that time resulting in some natural re-vegetation. Figure 12 is a topographic map of the area surrounding Hills and Dales Pit. Underlying geology consists of the Dolomitic and Basal nodular members of the Kainer Formation. The subject property is located within the Edwards Aquifer Recharge Zone in the UTSA karst faunal area.

The entrance to Hills and Dales Pit is located in the bottom of the channel of an unnamed tributary to Leon Creek. During runoff events it pirates most, if not all, of the discharge from that tributary to the subsurface. Water drains from the cave through a series of humanly impassible conduits along the perimeter and through the floor of the main room. Figures 13 and 14 are maps of the cave in plan and cross section views respectively. A hydrogeological evaluation of the preserve area, including the surface and sub-surface drainage areas of Hills and Dales Pit, has been conducted by Pape-Dawson Engineers and is included in Section 8.0.

On 29 October 2000, SWCA personnel conducted the first methodical biota survey of Hills and Dales Pit from 1:15pm until 6:25pm. During high runoff rain events a significant percentage of potential terrestrial karst invertebrate habitat becomes submerged as evidenced by the high water line which was visible in the main room. Conditions within Hills and Dales Pit were not optimal for biota collection during this survey due to heavy rains which flooded the main room of the cave during the previous week. In general, biological activity within the cave was low. Observations were sparse of collembola, cave crickets, and daddy-longlegs, which are typically occur in large numbers in such a cave. Many surfaces where terrestrial species of concern would be expected to occur were saturated with water and devoid of living organisms. Several drowned arachnids of various species were observed where they lay after flood waters receded. A live rattlesnake (*Crotalus atrox*) which had likely been washed into the cave during the recent rains was collected in the main room near the bottom of the entrance shaft and released at the surface. Results of the survey are summarized in Table AII-8. Temperature and humidity data were collected using a Hanna Instruments HI93640 digital thermohygrometer (Table AII-9).

Notable among the species encountered are the endangered species *R. exilis*, and *C. madla*, and possibly endangered arachnids of the genus *Texella* and *Neoleptoneta*. The *Cicurina* specimen was only the ninth adult female specimen of *C. madla* ever collected. This specimen makes Hills and Dales Pit the eighth confirmed location for *C. madla* (Cokendolpher pers. comm.).

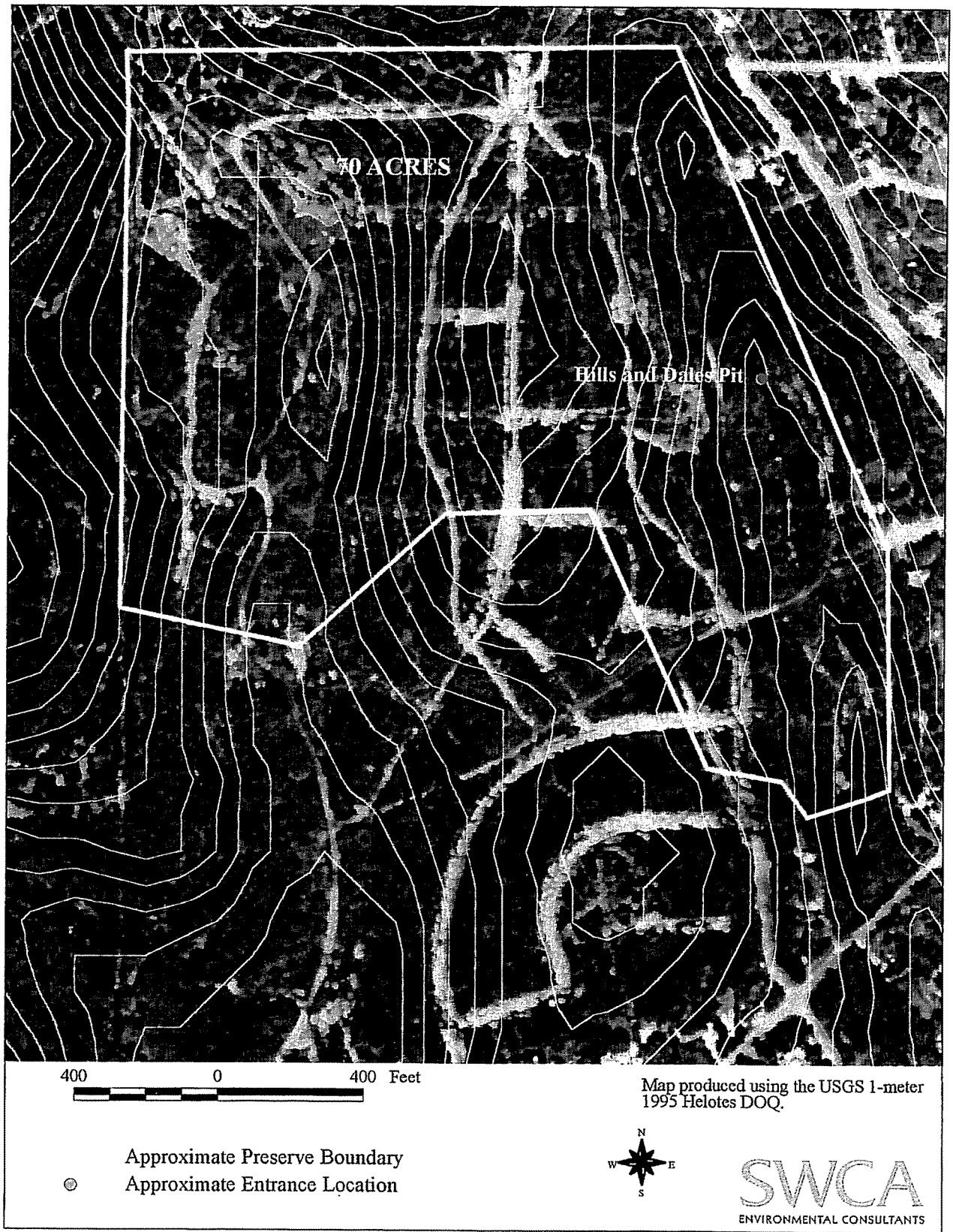


Figure 11. Hills and Dales Pit Preserve Boundary, Vegetation, and Adjacent Land Use.

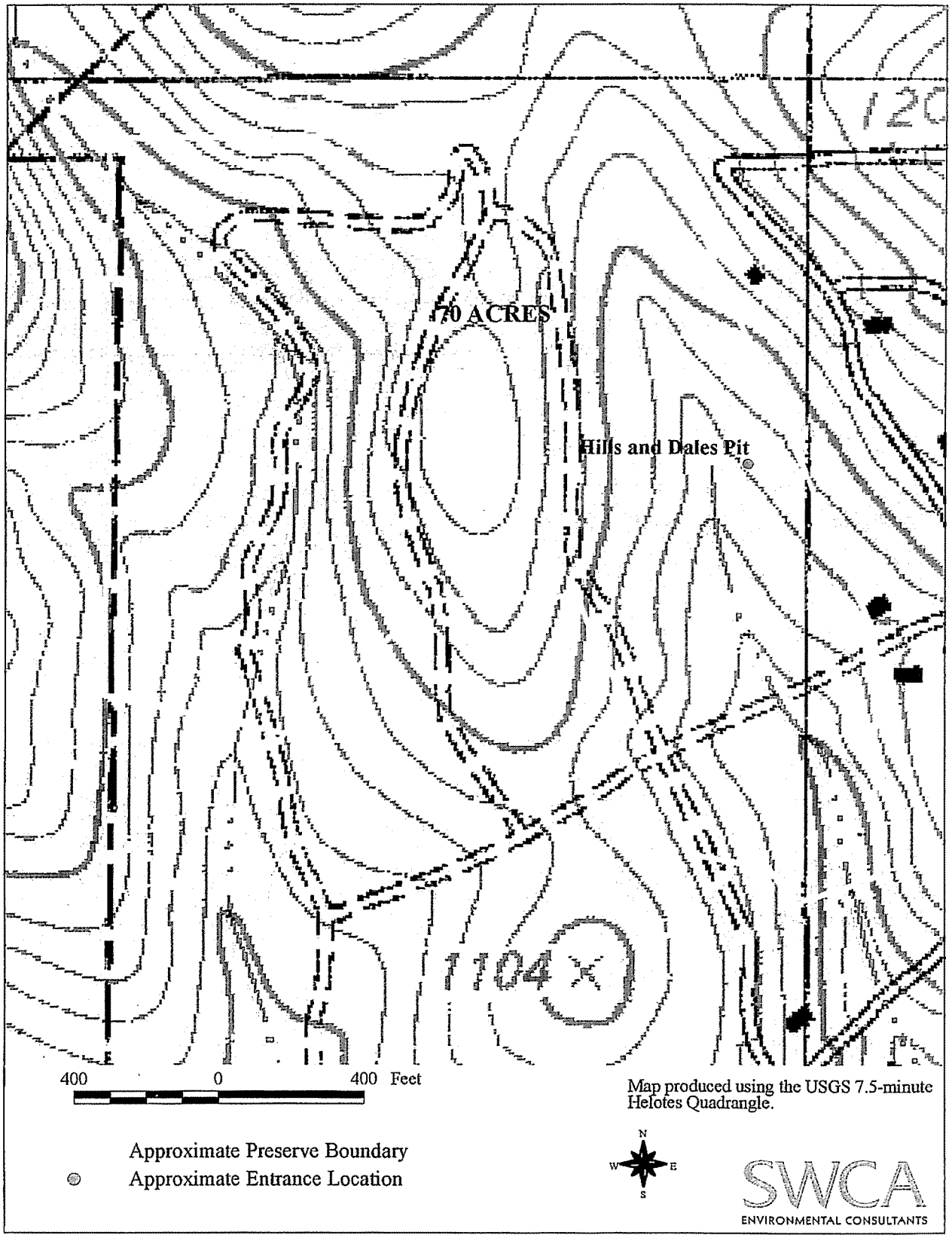


Figure 12. Topographic Map Showing Hills and Dales Pit Preserve Boundary, Vegetation, and Adjacent Land Use.

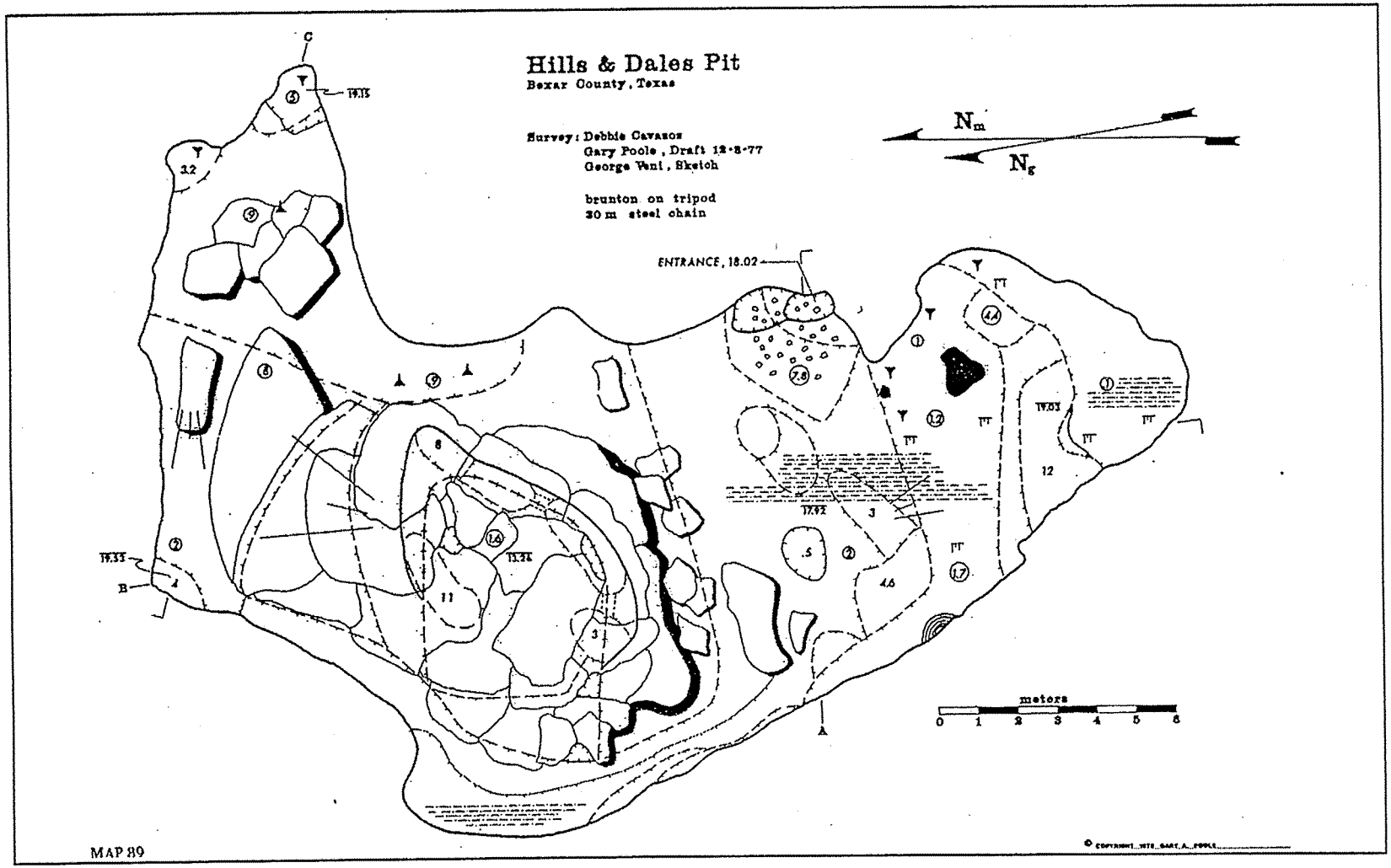


Figure 13. Hills and Dales Pit Map. Reprinted with author's permission from Veni, G., 1988, The Caves of Bexar County: 2nd Edition. Texas Memorial Museum Speleological Monograph, 2. p. 157.

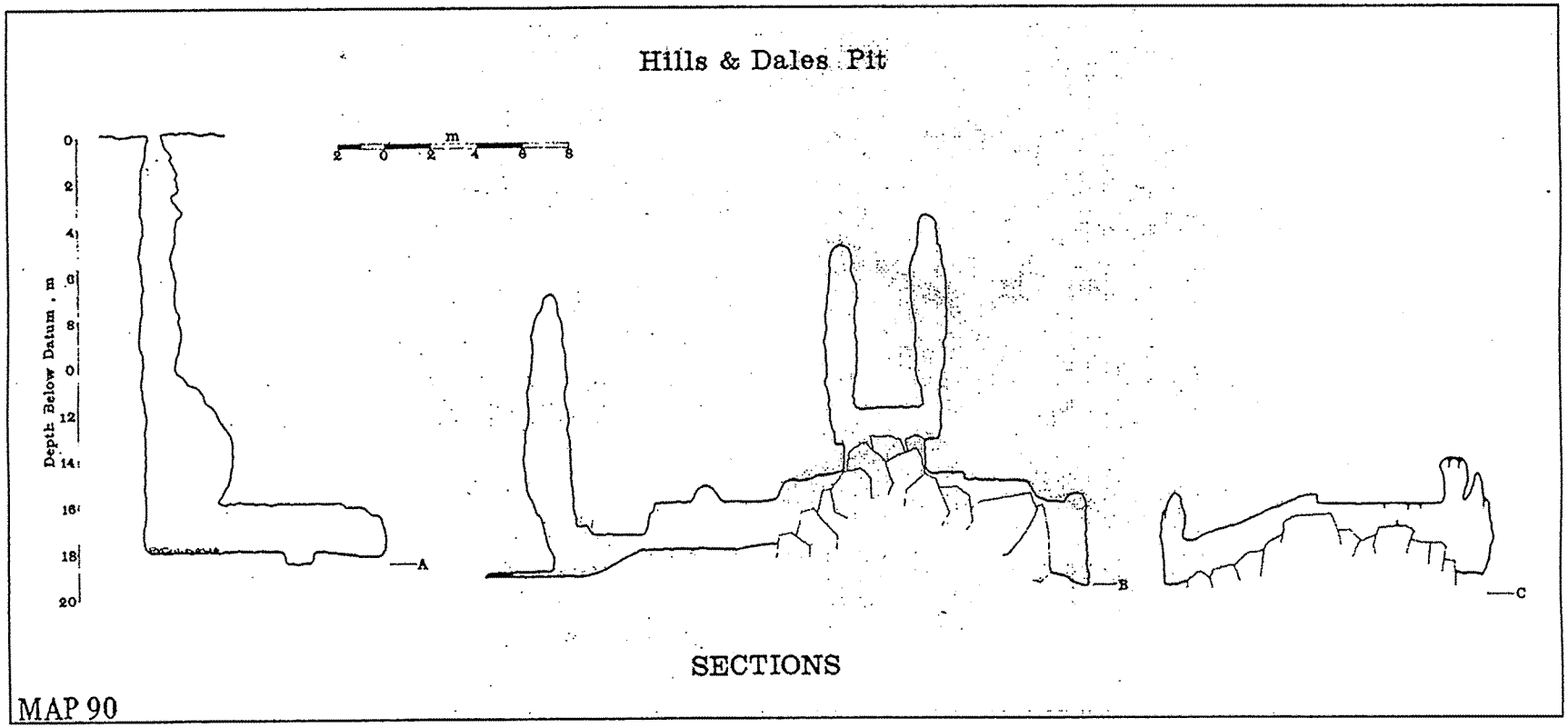


Figure 14. Hills and Dales Pit Map. Reprinted with author's permission from Veni, G., 1988, The Caves of Bexar County: 2nd Edition. Texas Memorial Museum Speleological Monograph, 2. p. 158.

Table AII-8. Biota of Hills and Dales Pit.

Common Name	Genus	Species	Classification	Number encountered	Behavior	Endangered Status
Snails	probably *Helicodiscus*	undetermined	Troglophile	1000's	record based mostly on empty shells	N/A
Terrestrial isopods	*Brackenridgia*	probably *cavernarum*	Troglobite	10's	sheltering	N/A
Spiders	*Cicurina*	*varians*	Troglophile	10's	sheltering	N/A
Spiders	*Neoleptoneta*	undetermined	Troglobite			N/A
Madla's Cave Meshweaver	*Cicurina*	*madla*	Troglobite	10's	sheltering	Endangered Species
Harvestmen	*Lieobunum*	*townsendii*	Trogloxene	100's	sheltering	N/A
Harvestmen	*Hoplobunus*	*madlae*	Troglobite	<10	sheltering / foraging	N/A
Harvestmen	*Texella*	probably undescribed / new species, possibly *cokendolpheri*	Troglobite	3	sheltering / foraging	Possibly an Endangered Species
Millipedes	*Speodesmus*	undetermined	Troglobite	10's	foraging	N/A
Springtails	*Pseudosinella*	probably *violenta*	Troglobite	10's	foraging	N/A
Silverfish	*Texoreddellia*	*texensis*	Troglobite	10's	foraging	N/A
Beetles	*Rhadine*	*exilis*	Troglobite	1	foraging	Endangered Species
Cave Crickets	*Ceuthophilus*	*cunicularis*	Trogloxene	<100	sheltering	N/A
Cave Crickets	*Ceuthophilus*	*secretus*	Trogloxene	<100	sheltering	N/A
Ants	*Solenopsis*	*invicta*	Accidental	<10	foraging	N/A
Mosquitoes	undetermined	undetermined	Accidental	10's	flying	N/A
Toads	undetermined	undetermined	Accidental	2	sheltering	N/A
Rattlesnake	*Crotalus*	*atrox*	Accidental	1	rattling, coiled	N/A

Table AII-9. Temperature and humidity data collected in Hills and Dales Pit.

Location	Surface	Bottom of Shaft	Main Room	Upper Level	Back Room	Flowstone Room
Relative Humidity	55.5%	98.5%	100%	99.8%	96.7%	96.9%
Temperature	44.3°F	66.5°F	68.0°F	70.2°F	72.0°F	72.3°

5.0 HELOTES HILLTOP / HELOTES BLOWHOLE CAVE PRESERVE

The Helotes Hilltop / Helotes Blowhole Cave Preserve comprises approximately 25 acres north of the intersection of Bandera Road and Scenic Loop Road approximately three quarters of a mile north of Helotes, Texas. Its connection to the Helotes Creek floodplain extends the effective acreage of the preserve by providing a connecting corridor to other biological reservoirs. Figure 15 is an aerial photo indicating the vegetative cover and location of the cave entrances. Figure 16 is a topographic map of the area surrounding Helotes Hilltop and Helotes Blowhole Caves.

Vegetation in the area consists generally of Ashe juniper (*Juniperus ashei*)/live oak (*Quercus virginiana*) woodland. Other deciduous species occurring in the area include hackberry (*Celtis* sp.), huisache (*Acacia farnesiana*), and mesquite (*Prosopis glandulosa*). Shrubs established in the area entail flame-leaf sumac (*Rhus laneolata*), agarita (*Berberis trifoliolata*), Texas persimmon (*Diospyros texana*), elbowbush (*Forestiera pubescens*), and netleaf forestiera (*Forestiera reticulata*).

Drainage on the property is generally toward Helotes Creek and its tributaries. Underlying geology consists of the Dolomitic and Basal nodular members of the Kainer Formation and the upper Glen Rose Formation. The subject property is located within the Edwards Aquifer Contributing Zone in the Helotes karst faunal area.

The entrance to Helotes Hilltop Cave is located as its name implies near the top of a hill overlooking the Helotes Creek valley. The Helotes Hilltop Cave entrance is only 1.5 feet in diameter but widens gradually as it drops 45 feet to a main passage. From the main passage the cave branches into two levels. Each level is made up of a maze of passages, domes, fissures, and crawls (See Figure 17). The Helotes Blowhole entrance is in a bluff above Helotes Creek east of Helotes Hilltop Cave. Helotes Blowhole Cave consists primarily of a single passage measuring approximately 351 feet long and an average of 4 feet in diameter (See Figure 18). It has been estimated Helotes Blowhole serves as a resurgence for water insurging through Helotes Hilltop Cave (Veni 1988). A hydrogeological evaluation of the preserve area has been conducted by Pape-Dawson Engineers and is included in Section 8.0. As can be seen from aerial photography (Figure 15) significant adjacent undeveloped acreage remains intact. Repeated attempts by the La Cantera Endangered Species Compliance Committee to persuade neighboring landowners to sell their holdings have failed. Notification by USFWS of neighboring landowners of their responsibilities under the Federal ESA should curtail further encroachment on the potential preserve area.

Biological collections and list of fauna for both karst features have been documented since 1964[8]. Biota data were gathered from Veni (1988), Reddell (1997and1993) and are given in Table AII-10. Red imported fire ants have not been observed in the area of the Helotes Hilltop/Blowhole Preserve. Helotes Hilltop Cave is the type location for *Batrisodes venyivi* first discovered there in 1984 and currently known from only three caves. Conservation of Helotes Hilltop and Helotes Blowhole Caves will achieve the conservation of at least eleven troglobitic species including four endangered species.

---

[8]Veni, Caves of Bexar County 2nd Edition, 1988.

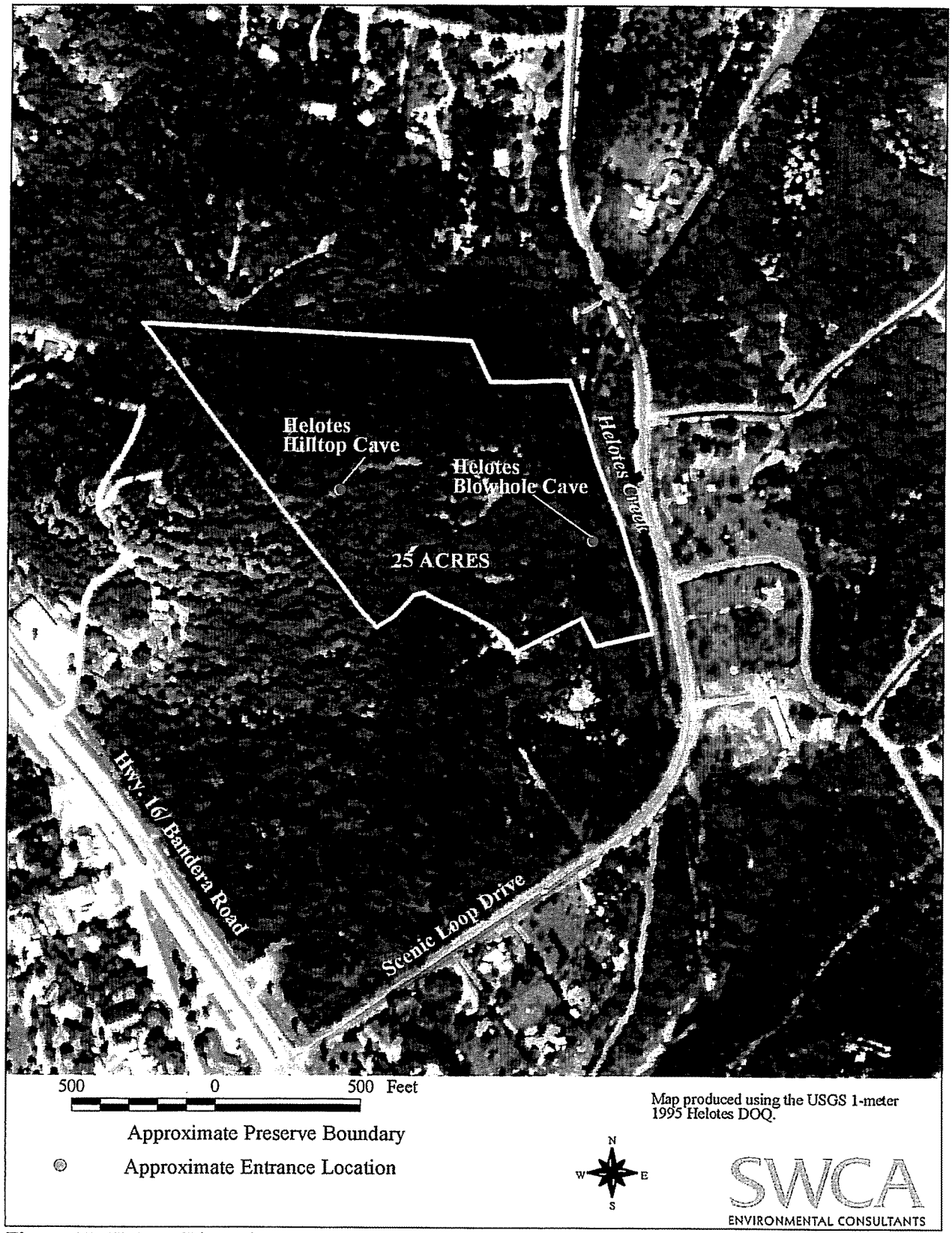


Figure 15. Helotes Hilltop/ Helotes Blowhole Preserve Boundary, Vegetation and Adjacent Land Use.

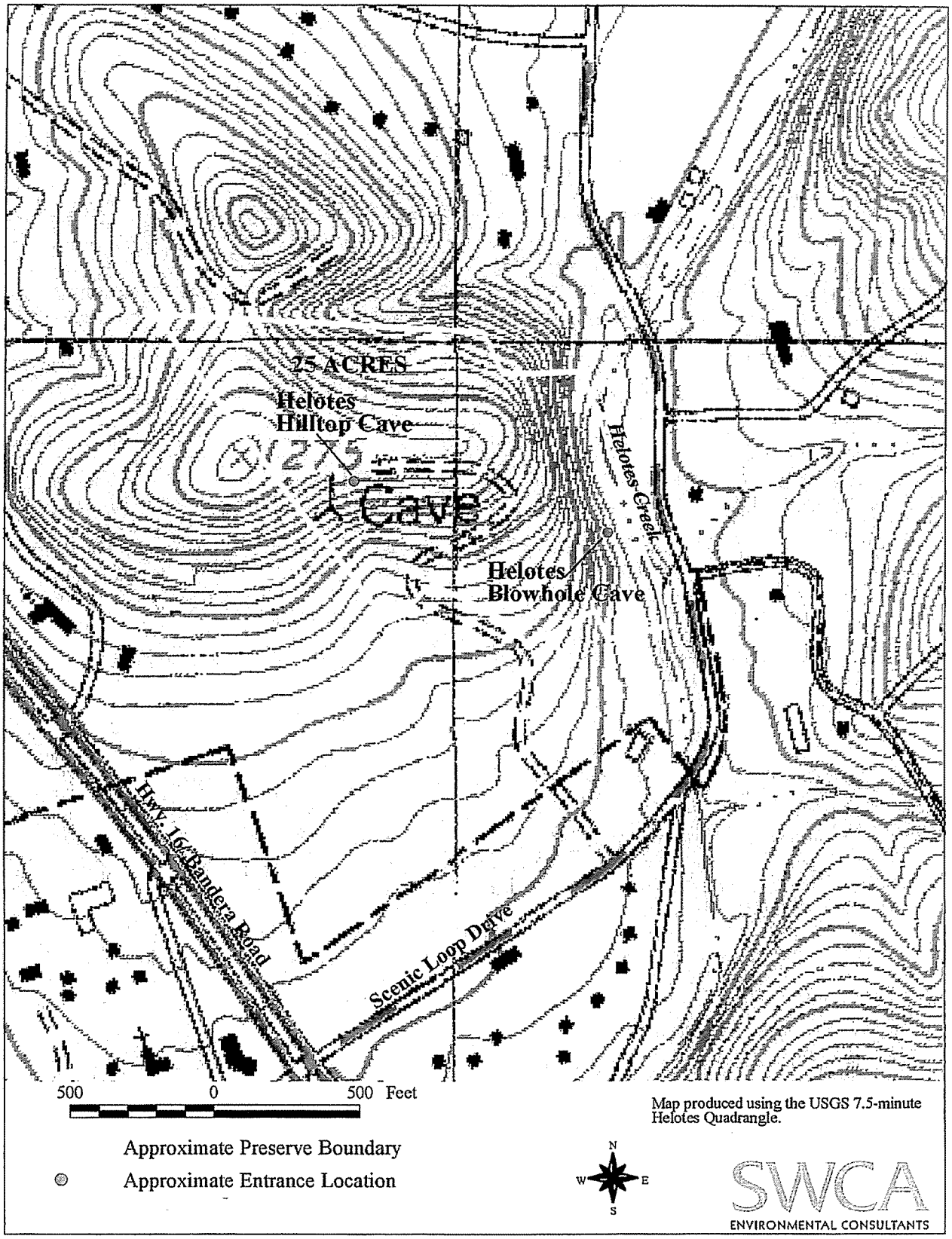


Figure 16. Topographic Map Showing Helotes Hilltop/ Helotes Blowhole Preserve Boundary, Vegetation and Adjacent Land Use.

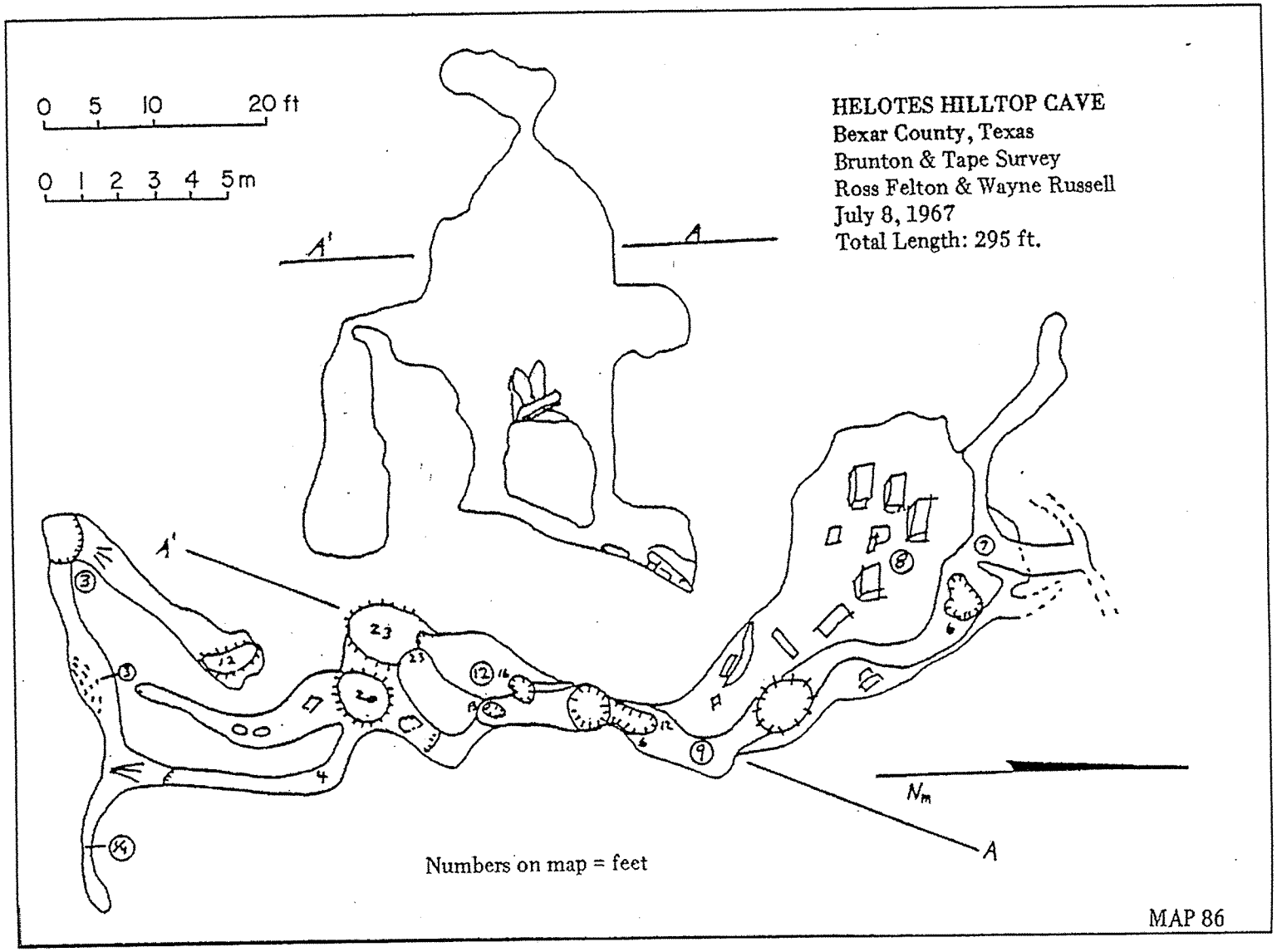


Figure 17. Helotes Hilltop Cave Map. Reprinted with author's permission from Veni, G., 1988, The Caves of Bexar County: 2nd Edition. Texas Memorial Museum Speleological Monograph, 2. p. 153.

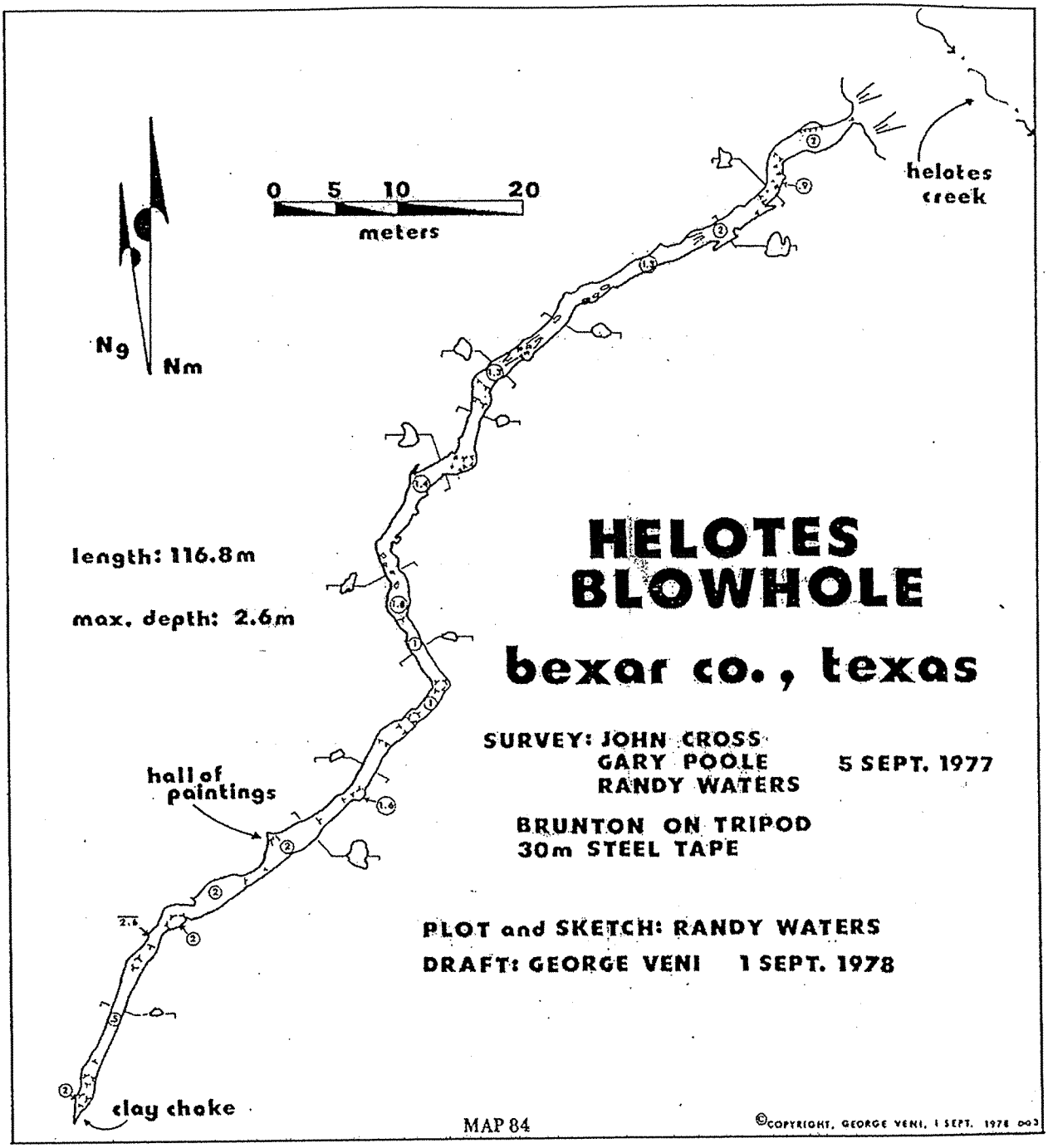


Figure 18. Helotes Blowhole Cave Map. Reprinted with author's permission from Veni, G., 1988, The Caves of Bexar County: 2nd Edition. Texas Memorial Museum Speleological Monograph, 2. p. 150.

Table AII-10. Biota of the Helotes Hilltop / Helotes Blowhole Cave Preserve.Table 9. Biota of the Helotes Hilltop / Helotes Blowhole Cave Preserve.

Taxon encountered	Common Name
Batrisodes (Excavodes) venyivi	Helotes Mold Beetle, endangered species
Cambala speobia	troglobitic millipede
Ceuthophilus cunicularis	cave cricket
Ceuthophilus secretus	cave cricket
Cicurina madla	Madla's Cave Meshweaver, endangered species
Cicurina varians	eyed troglobitic spider
Eustilicus condei	rove beetle
Hoplobunus madla	troglobitic harvestman
Myotis velifer incautus	Mexican brown bat
Leiobunum townsendii	daddy longlegs
Oniscoidea	isopod
Pipistrellus sp.	bat
Pselaphidae	antloving beetle
Pseudosinella violenta	troglobitic springtail
Rhadine exilis	troglobitic ground beetle, endangered species
Rhadine infernalis	troblobitic ground beetle, endangered species
Speodesmus sp.	troglobitic millipede
Syrrhophus marnocki	cliff frog
Tenebrionidae	darkling beetle
Texoreddellia texensis	troglobitic silverfish
Trichoniscidae	isopod
Vaejovis reddelli	troglobitic scorpion

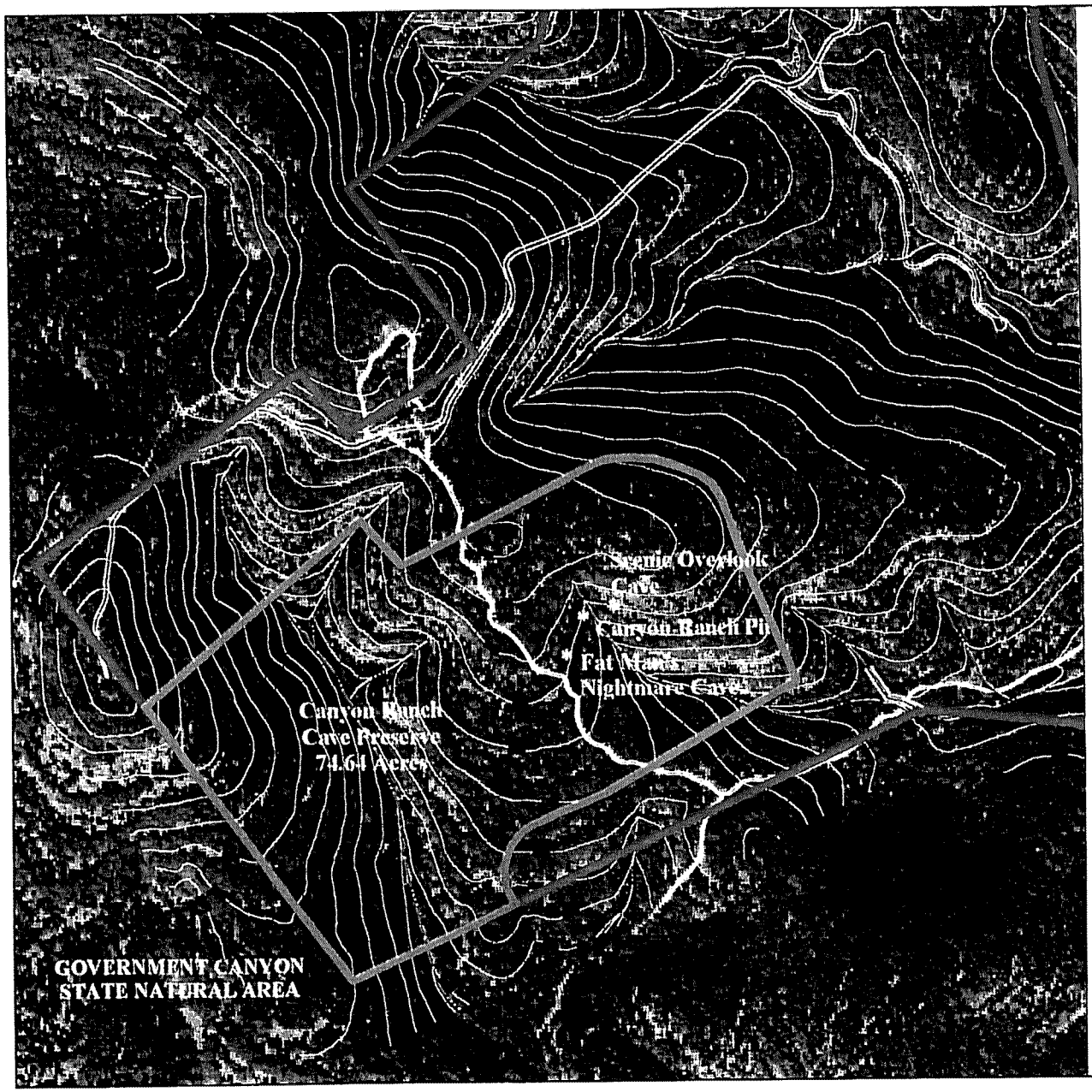
6.0 CANYON RANCH CAVE PRESERVE

The Canyon Ranch Cave Preserve consists of 74.6-acres of uplands and hillsides located directly adjacent to Government Canyon State Natural Area. Figure 19 is an aerial-photo-based map of the Canyon Ranch Cave Preserve. This preserve contains three caves known as Scenic Overlook Cave, Canyon Ranch Pit, and Fat Man's Nightmare Cave. In May and June of 2000 these caves were mapped by Horizon (Figures 20 through 25) and biota surveys were conducted by SWCA. Specimen identifications were confirmed by Dr. James Reddell, Dr. James Cokendolpher, and Darrell Ubick. Table AII-11 summarizes the results of those biota surveys. Hydrogeologic assessments of these caves have been conducted by SWCA and the results are summarized in Section 8.0.

6.1 Scenic Overlook Cave

Scenic Overlook Cave formed within a transitional horizon between the Grainstone and Kirschberg members of the Kainer Formation of the Edwards Group limestone. The entrances of Scenic Overlook Cave is located at an elevation of approximately 1,409 feet on a limestone ledge near the headwaters of a steep southeastern draining tributary to Ranch Creek within the Los Reyes Creek drainage basin. Scenic Overlook Cave formed under phreatic conditions, below the water table. Circulating ground water gradually dissolved and removed relatively soluble limestone in the strata in which the caves are formed, creating void space. This most likely occurred preferentially along BFZ oriented rock joints and other fractures which are currently visible in the cave walls and ceilings. As the water table dropped due to stream incision and general denudation of the land surface, Scenic Overlook Cave became perched above the water table in the vadose zone. Subsequent collapse and modification by vertically infiltrating vadose waters have contributed to the current morphology of the cave and have largely obscured additional clues as to the genesis of the cave.

The entrance to Scenic Overlook Cave is formed in solid limestone along a N40°W trending fracture and measures approximately 2.5 feet long and 1.5 feet wide. The entrance passage extends at an incline for approximately 9.5 feet to a narrow 20-foot long stair-step passage that trends to the east-northeast to the eastern-most part of the cave. At that point, there is an irregularly-shaped room measuring approximately 20 feet in diameter with ceiling heights ranging from 0.5 to 4 feet. From this room, a broad, low bedding plane crawl continues to the west-southwest to a 10-foot wide by 1 to 2 foot high crawl way that extends for approximately 41 feet to the west and the main chamber where the primary terrestrial karst invertebrate habitat occurs. Flowstone and breakdown divide this chamber into southern, eastern, and western portions. Flowstone is present at the northern-most extent of the room and appears to have been formed by water introduced from two small conduits in the ceiling extending vertically and slightly to the north for an undetermined distance. The flowstone does not appear to be active as it was dry during multiple visits and has had sediment deposited upon it. Relatively abundant speleothems are located in the first room and in the western most room of the cave, but none appear to be particularly active. Figures 20 and 21 are maps of Scenic Overlook Cave which have been re-drafted and now identify the photic zones, and primary karst invertebrate habitat areas.



N

400 0 400 800

DRAWING SCALE: 1"= 400'

Property Boundary

Karst Preserve Boundary

Figure 19

Canyon Ranch Cave Preserve

MAP PRODUCED USING THE USGS 1-METER 1995 HELOTES DOQ.

SWCA INC. ENVIRONMENTAL CONSULTANTS

1713 Rio Grande, Suite C • Austin, Texas 78701

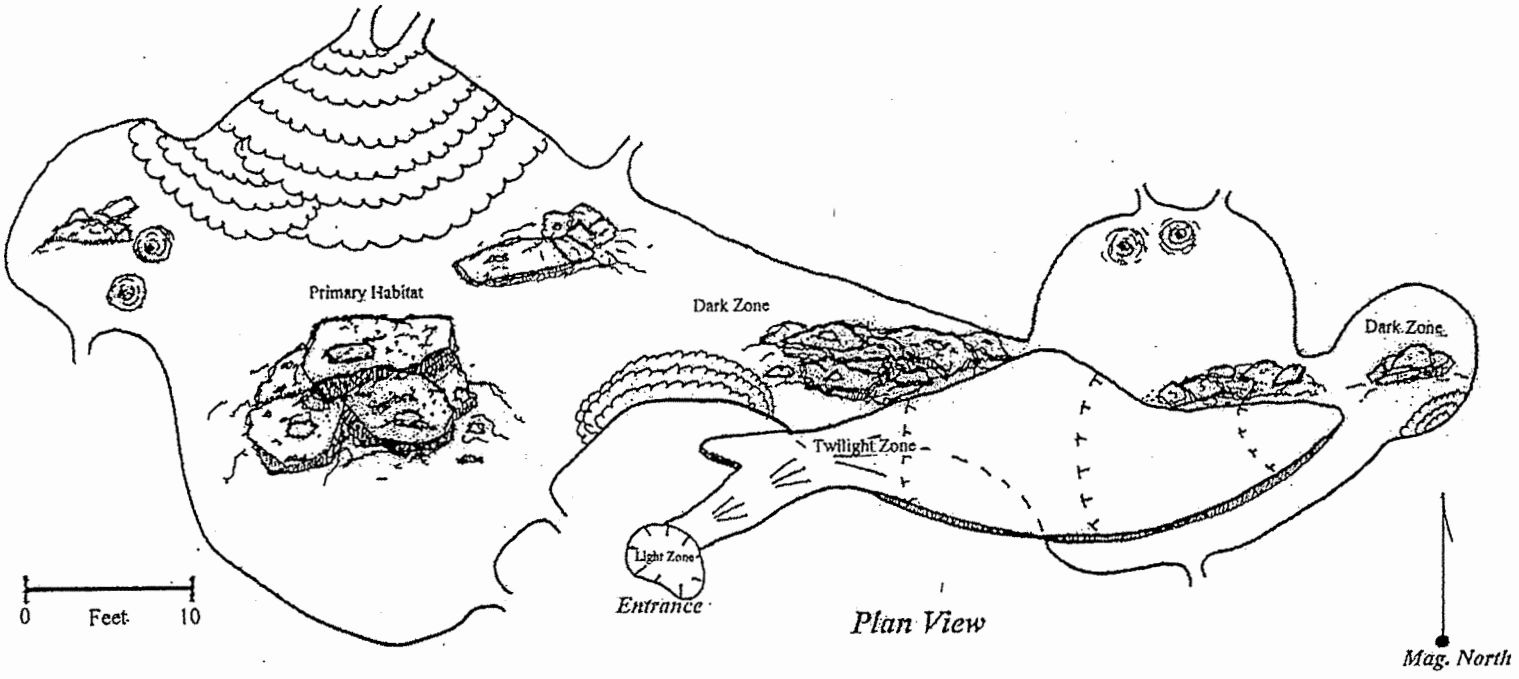


FIGURE 20.

SCENIC OVERLOOK CAVE

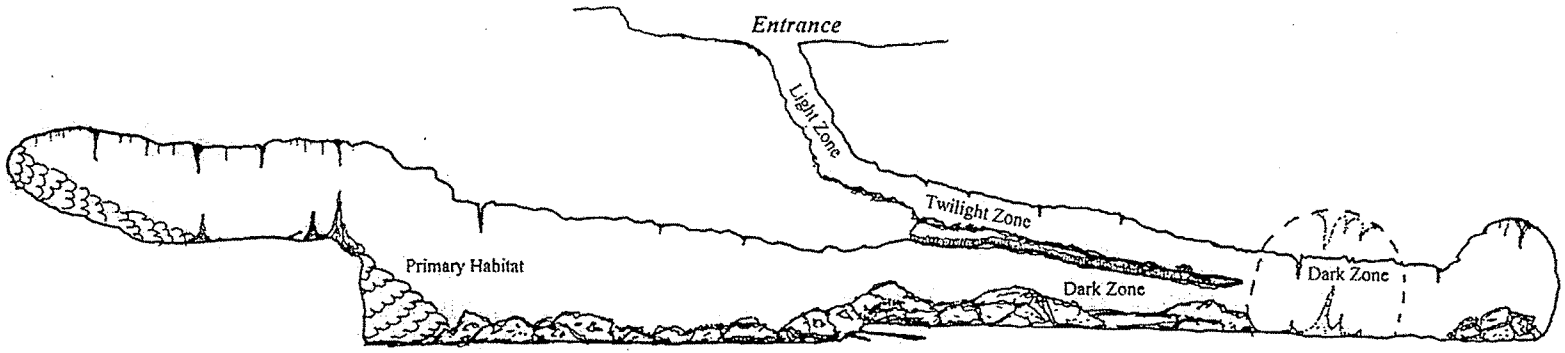
Bexar County, Texas .

Tape and Suunto survey performed on 22 May 2000 by:
Kristin Miller, Kemble White, Hub Bechtol,
Brad Sappington, and Joe Waring.

Redrafted on 12 and 13 February 2001 by Hub Bechtol.

FIGURE 21. ***SCENIC OVERLOOK CAVE***

Bexar County, Texas .
Tape and Suunto survey performed on 22 May 2000 by:
Kristin Miller, Kemble White, Hub Bechtol,
Brad Sappington, and Joe Waring.
Redrafted on 12 and 13 February 2001 by Hub Bechtol.



Projected Profile Facing North

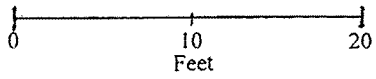


FIGURE 22. ***CANYON RANCH PIT***

Bexar County, Texas .
Tape and Suunto survey performed on 9 June 2000 by:
Kristin Miller, Kemble White, Hub Bechtol,
Brad Sappington, Brian Hunt, and Joe Waring.
Redrafted on 12 and 13 February 2001 by Hub Bechtol.

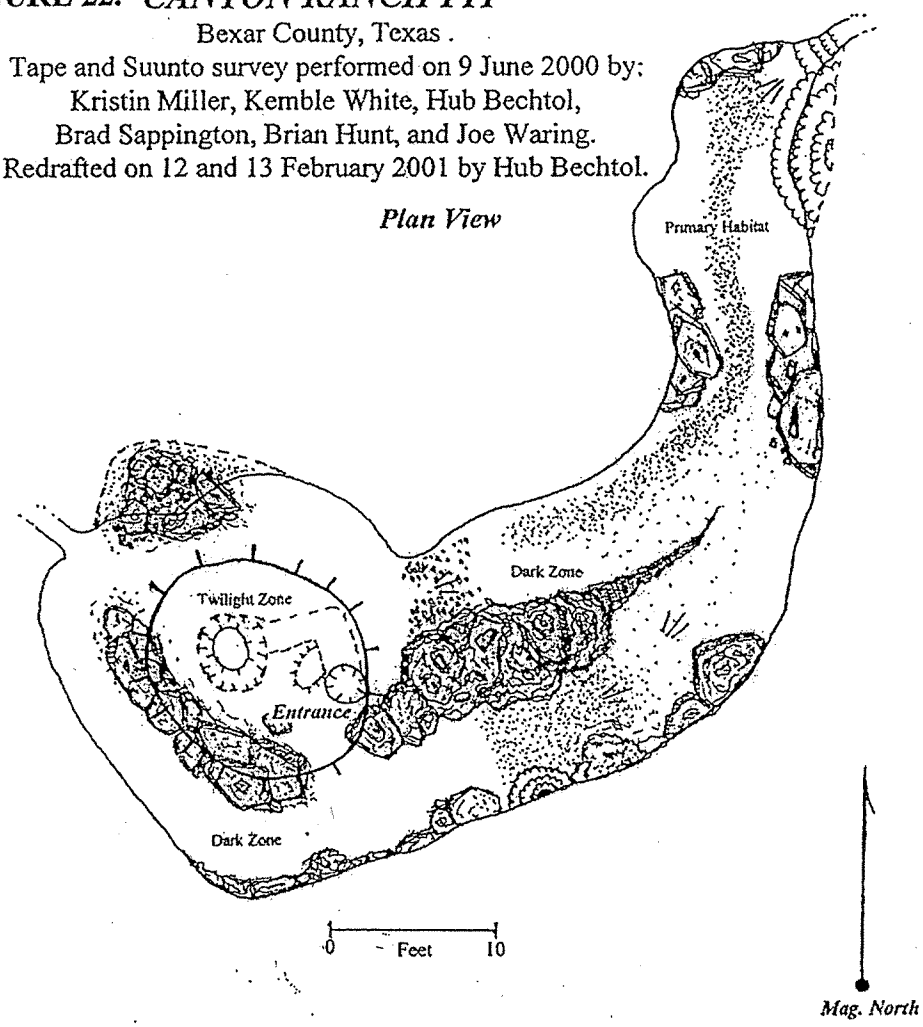
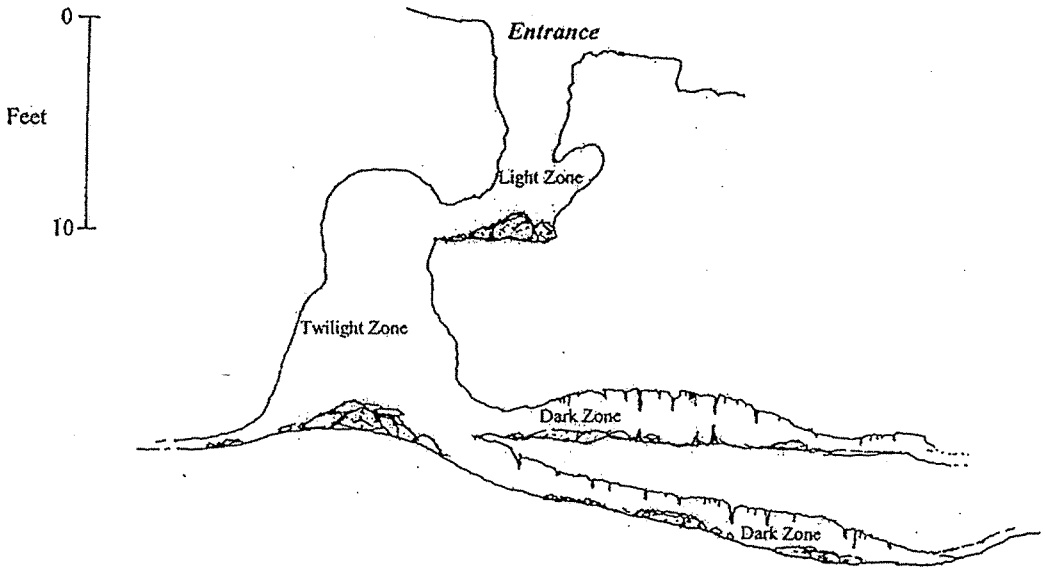


FIGURE 23. *CANYON RANCH PIT*

Bexar County, Texas .
Tape and Suunto survey performed on 9 June 2000 by:
Kristin Miller, Kemble White, Hub Bechtol,
Brad Sappington, Brian Hunt, and Joe Waring.
Redrafted on 12 and 13 February 2001 by Hub Bechtol.



Projected Profile Facing North

FIGURE 24. *FAT MAN'S NIGHTMARE CAVE*

Bexar County, Texas .
Tape and Suunto survey performed on 5 June 2000 by:
Kristin Miller, Kemble White, Hub Bechtol,
Brad Sappington, Brian Hunt, and Greg Lee Sherrod.
Redrafted on 12 and 13 February 2001 by Hub Bechtol.

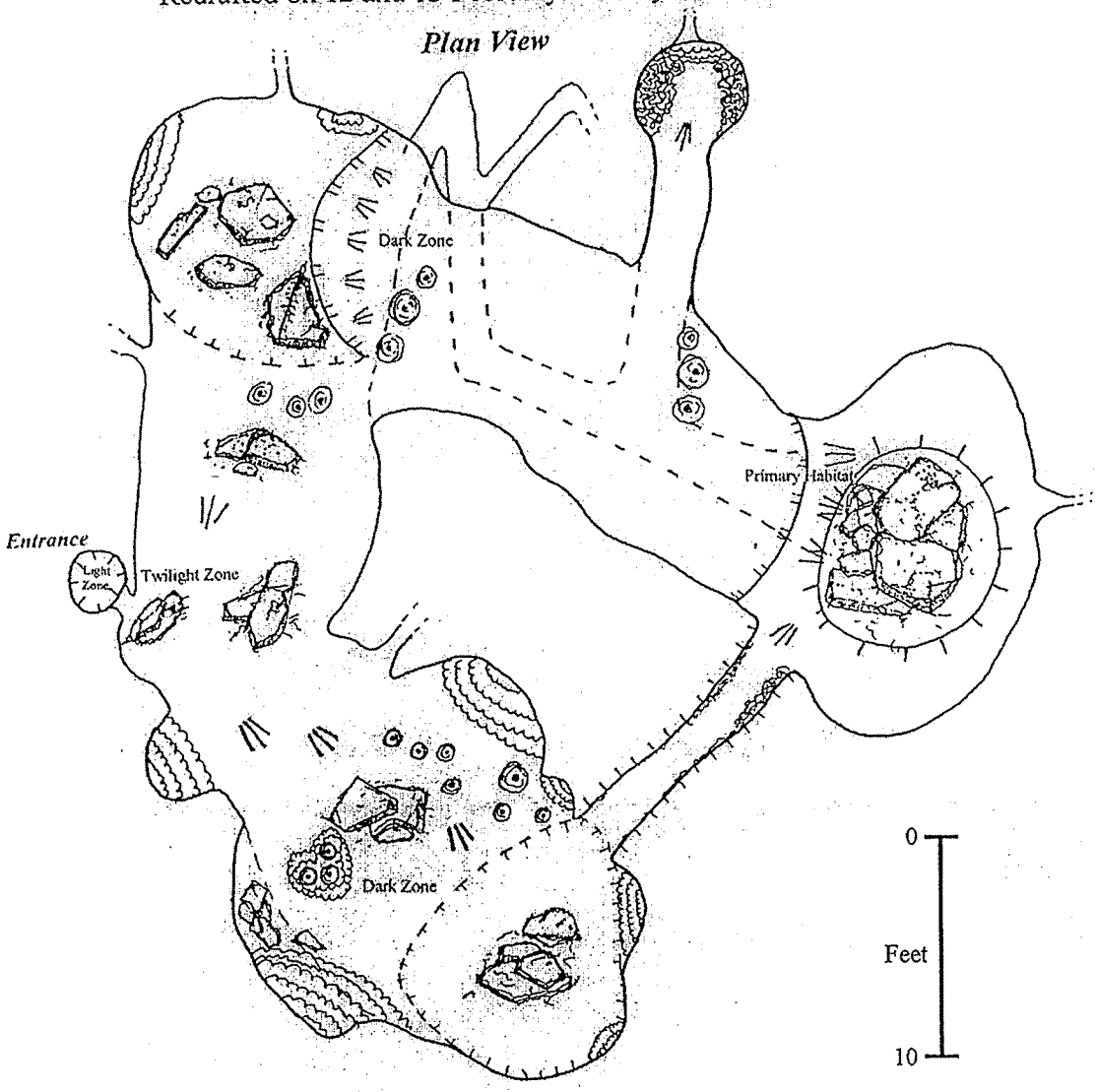
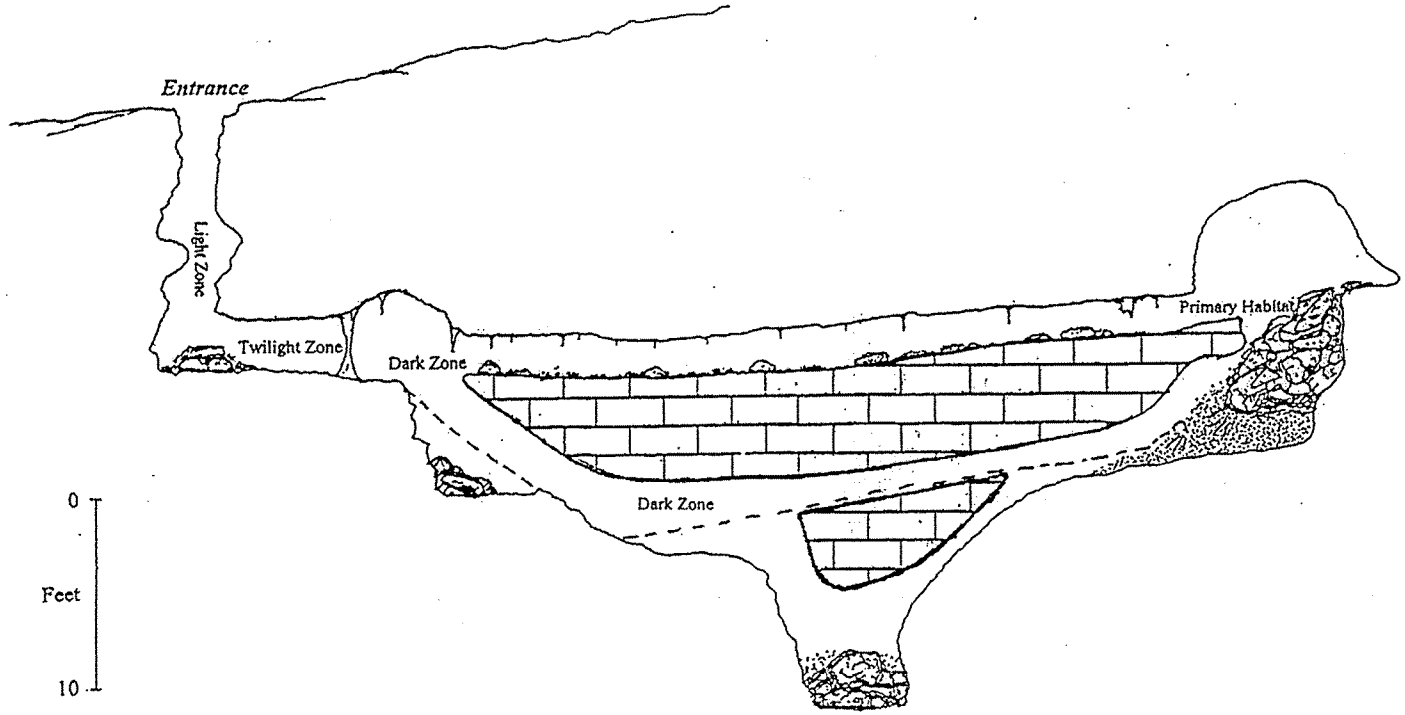


FIGURE 25. *FAT MAN'S NIGHTMARE CAVE*

Bexar County, Texas .
Tape and Suunto survey performed on 5 June 2000 by:
Kristin Miller, Kemble White, Hub Bechtol,
Brad Sappington, Brian Hunt, and Greg Lee Sherrod.
Redrafted on 12 and 13 February 2001 by Hub Bechtol.



Projected Profile Facing North

Table AII-11. Biota of Scenic Overlook Cave.

Taxon encountered	Common Name	Number Observed (*estimate)	
		5/11/2000	5/22/2000
Rhadine infernalis	Troglobitic ground beetle	6	4
Rhadine howdeni	Ground beetle	2	3
Batrisodes venyivi	Helotes mold beetle	2	0
Texoreddellia texensis	Troglobitic silverfish	100's*	100's*
Ceuthophilus cunicularis	Cave cricket	100's*	100's*
Ceuthophilus secretus	Cave cricket	100's*	100's*
Pseudosinella sp.	Springtail	100's*	100's*
Cicurina varians	Spider	10's*	10's*
Cicurina sp., likely *C. madla*	Troglobitic spider	10's*	10's*
Rhagidita sp.	Mite	3	5
Vaejovis reddelli	Troglobitic scorpion	10's*	10's*
Hoplobunus madlae	Troglobitic harvestman	4	7
Texella sp.	Troglobitic harvestman	3	2
Lieobunum sp.	Daddy longlegs	100's*	100's*
Cambala speobia	Troglobitic cave millipede	100's*	100's*
Speodesmus sp.	Troglobitic cave millipede	10's*	10's*
Brackenridgia sp.	Troglobitic isopod	10's*	10's*
Helicodiscus eigenmanni	Snail	100's*	100's*
Syrrhophus marnocki	Chirping Frog	4	6
Bufo sp.	Toad	0	1
Myotis velifer	Bat	1	3
Procyon lotor	Racoon	scat observed	scat observed
Erethizontidae dorsatum	Porcupine	scat observed	scat observed

Biological surveys of Scenic Overlook Cave were conducted by SWCA personnel including Kemble White, Hub Bechtol, Brad Sappington, and Dr. Steven Carothers on 10 and 22 May 2000. The biological survey conducted on 11 May began at 11:45 a.m. and ended at 3:30 p.m.. Surface weather conditions were mostly sunny with highs in the upper 80's (F) with no precipitation. The entrance was blowing air slightly and conditions above the entrance at the beginning of the survey were 86.5 °F at 67.8% relative humidity. Temperature and humidity data were collected at three locations each progressively further into the cave using a Hanna Instruments HI 93640 digital thermohygrometer. At the end of the entrance passage in the easternmost chamber the temperature was 76.3 °F at 72.5% relative humidity. At roughly the midpoint of the lower portion of the cave at the eastern edge of the main chamber the temperature was 73.9 °F at 79.3% relative humidity. In the southern portion of the main chamber the temperature was 71.8 °F at 85.7% relative humidity. The 23 May biological collection was slightly less formal as it was conducted while assisting Horizon Environmental Services with a cartographic survey of the cave. On that date climate data were only collected in the center of the main chamber which was 75.6°F at 73.8% relative humidity at 3:30 p.m..

Scenic Overlook Cave is notable in that it has, to date, been shown to contain ten troglobitic species including *Rhadine infernalis*, and *Batrisodes venyivi* (Third known location) which are endangered taxa, as well as eyeless populations of the genus *Texella* and *Cicurina* which likely belong to endangered taxa. As this cave is further studied it is reasonably expected that additional taxa will be encountered. The results of biota collections to date are given in Table AII-11.

6.2 Canyon Ranch Pit

Canyon Ranch Pit likely formed in the same manner as both Scenic Overlook Cave and Fat Man's Nightmare Cave. The entrance is located at an elevation of approximately 1,410 feet on a limestone ledge just above the headwaters of a steep southeastern draining tributary to Ranch Creek within the Los Reyes Creek drainage basin.

Canyon Ranch Pit is a phreatic void measuring roughly 65 feet by 30 feet which has been modified by collapse. The entrance to Canyon Ranch Pit measures approximately 2.5 feet in diameter. The entrance shaft drops vertically for approximately 5 feet where it jogs slightly to the west and drops for an additional 15 feet into the entrance chamber. The room is at its maximum height where the entrance shaft meets it and thins in all directions along a breakdown pile towards the walls of the cave. All passage development beyond that point is relatively horizontal. A crawl formed in breakdown continues to the east then north from the entrance room for a total distance of 55 feet. Two bedding plane partings occur through this crawl way with a narrow, vertical pathway eroded through that allows access. Although speleothems are relatively abundant in the cave, they do not appear to be active, as they are coated with organic staining. Figures 22 and 23 are maps of Canyon Ranch Pit which have been re-drafted and now identify the photic zones, and primary karst invertebrate habitat areas.

A biological survey of Canyon Ranch Pit was conducted by SWCA personnel including Kemble White, Hub Bechtol, and Brad Sappington on 9 June 2000. The biological survey began at 11:15 p.m. and ended at 2:10 p.m.. Surface weather conditions were mostly sunny with highs in the mid

90's (F) with no precipitation. The entrance was blowing air slightly and conditions above the entrance at the beginning of the survey were 86.5 °F at 67.8% relative humidity. Temperature and humidity data were collected at two locations in the cave using a Hanna Instruments HI 93640 digital thermohygrometer. In the center of the entrance room the temperature was 78.1 °F at 58.7% relative humidity. At the north easternmost extent of the cave the temperature was 73.3 °F at 70.6% relative humidity.

Fat Man's Nightmare cave has been shown to contain six troglobitic species including *Rhadine infernalis*, which is endangered, as well as an eyeless population of the genus *Cicurina* which likely belongs to an endangered taxa, *C. madla*. As this cave is further studied it is reasonably expected that additional taxa will be encountered. The results of biota collections to date are given in Table AII-12.

Table AII-12. Biota of Canyon Ranch Pit.

Taxon encountered	Common Name	Number Observed (*estimate)
		6/9/2000
Rhadine infernalis	Troglobitic ground beetle	1
Texoreddellia texensis	Troglobitic silverfish	*100's**
Ceuthophilus cunicularis	Cave cricket	*100's**
Ceuthophilus secretus	Cave cricket	*100's**
Pseudosinella sp.	Springtail	*1000's**
Cicurina varians	Spider	*10's**
Cicurina sp., likely *C. madla*	Troglobitic spider	*10's**
Vaejovis reddelli	Troglobitic scorpion	*10's**
Lieobunum sp.	Daddy longlegs	*1000's**
Cambala speobia	Troglobitic cave millipede	10's*
Speodesmus sp.	Troglobitic cave millipede	10's*
Helicodiscus eigenmanni	Snail	100's*
Syrrhophus marnocki	Chirping Frog	1
Procyon lotor	Racoon	scat observed

6.3 Fat Man's Nightmare Cave

Fat Man's Nightmare Cave likely formed in the same manner as Scenic Overlook Cave. The entrance is located approximately 30 feet northeast of a ranch road at an elevation of approximately 1,409 feet on a limestone ledge near the headwaters of a steep southeastern draining tributary to Ranch Creek within the Los Reyes Creek drainage basin.

Fat Man's Nightmare Cave is a phreatic chamber measuring roughly 70 feet in diameter which has been divided into several rooms and crawlways by collapse and breakdown materials. The entrance to Fat Man's Nightmare Cave is formed in solid limestone along a N60°W trending fracture and measures approximately 2.5 feet long by 1.5 feet wide. The entrance shaft drops vertically for 10 feet to the entrance chamber. The entrance chamber measures approximately 30 feet in diameter with ceiling heights ranging from 0.5 to 4 feet. A large cricket guano pile is present in this chamber. From the entrance chamber, two rooms–one to the north and the other to the southeast–are visible. The room to the southeast measures approximately 15 feet in diameter. The floor of the room is composed of breakdown material and cricket guano. A crawl way extends to the northeast from this room to another room located at the eastern-most extent of the cave. This room measures roughly 15 feet in diameter with a maximum height of 13 feet. Phreatic pressure doming has been preserved in the ceiling and the ends of several tree roots hang from rock joints in the ceiling. Several impassible conduits formed along fractures extend from this room for an undetermined distance. From this room, an upper crawl extends to the northwest for approximately 25 feet to the room located just north of and connected to the entrance chamber. In general, speleothems are sparse in the cave. Figures 24 and 25 are maps of Fat Man's Nightmare Cave which have been re-drafted and now identify the photic zones, and primary karst invertebrate habitat areas.

Biological surveys of Fat Man's Nightmare Cave were conducted by SWCA personnel including Kemble White, Hub Bechtol, and Brad Sappington on 25 May and 5 June 2000. The biological survey conducted on 25 May began at 12:45 p.m. and ended at 4:10 p.m.. Surface weather conditions were partly cloudy with highs in the upper 80's (F) with no precipitation. The entrance was blowing air slightly and conditions above the entrance at the beginning of the survey were 86.5°F at 67.8% relative humidity. Temperature and humidity data were collected at two locations in the cave using a Hanna Instruments HI 93640 digital thermohygrometer. In the center of the entrance chamber the temperature was 83.2°F at 60.5% relative humidity. At roughly the center of the southernmost room the temperature was 76.1°F at 66.4% relative humidity. The 5 June biological collection was slightly less formal as it was conducted while assisting Horizon Environmental Services with a cartographic survey of the cave. On that date climate data were not collected.

Fat Man's Nightmare Cave is notable in that it has, to date, been shown to contain eight troglobitic species including *Rhadine infernalis*, which is endangered, as well as eyeless populations of the genus *Texella* and *Cicurina* which likely belong to endangered taxa. Fat Man's Nightmare Cave also has the largest observed cave cricket population of the three Canyon Ranch Preserve caves. As this cave is further studied it is reasonably expected that additional taxa will be encountered. The results of biota collections to date are given in Table AII-13.

Table AII-13. Biota of Fat Man's Nightmare Cave.

Taxon encountered	Common Name	Number Observed (*estimate)	
		5/25/2000	6/5/2000
Rhadine infernalis	Troglobitic ground beetle	2	1
Texoreddellia texensis	Troglobitic silverfish	100's*	100's*
Ceuthophilus cunicularis	Cave cricket	1000's*	1000's*
Ceuthophilus secretus	Cave cricket	1000's*	1000's*
Pseudosinella sp.	Springtail	1000's*	1000's*
Cicurina varians	Spider	10's*	10's*
Cicurina sp., likely *C. madla*	Troglobitic spider	10's*	10's*
Vaejovis reddelli	Troglobitic scorpion	10's*	10's*
Texella sp.	Troglobitic harvestman	1	0
Lieobunum sp.	Daddy longlegs	1000's*	1000's*
Cambala speobia	Troglobitic cave millipede	100's*	100's*
Speodesmus sp.	Troglobitic cave millipede	10's*	10's*
Brackenridgia sp.	Troglobitic isopod	2	5
Helicodiscus eigenmanni	Snail	100's*	100's*
Syrrhophus marnocki	Chirping Frog	3	4
Bufo sp.	Toad	3	2
Procyon lotor	Racoon	scat observed	scat observed

7.0 MADLA'S CAVE PRESERVE

Madla's Cave is located one half mile west of Scenic Loop Road and one quarter mile south of Chimenea Creek in Bexar County, Texas. Figure 26 is an aerial photo indicating the vegetative cover, surrounding land use, and location of the cave entrance. Total acreage for the Madla's Cave Preserve is 5 acres within a conservation easement negotiated with the land owner in August 2000. Figure 27 is a topographic map of the area surrounding Madla's Cave. A hydrogeological evaluation of the preserve area was published by George Veni[9] in October, 1996. A delineation of the surface and sub-surface drainage areas of Madla's Cave is included in Section 8.0. The preserve encompasses the entire surface drainage area and approximately 80 percent of the potential subsurface drainage area as delineated by Veni. Development of the remaining 20 percent of the subsurface drainage area is largely precluded by the orientation and geometry of the conservation easement.

Drainage on the property is generally toward Chimenea Creek and its tributaries. Underlying geology consists of the Edwards Group Limestone and the upper Glen Rose Formation. The subject property is located within the Edwards Aquifer Contributing Zone in the Helotes karst faunal area.

Vegetation in the area generally consists of Ashe juniper (*Juniperus ashei*)/live oak (*Quercus virginiana*) woodland. Other deciduous species occurring in the area include hackberry (*Celtis* sp.), huisache (*Acacia farnesiana*), and mesquite (*Prosopis glandulosa*). Shrubs established in the area entail flame-leaf sumac (*Rhus laneolata*), agarita (*Berberis trifoliolata*), Texas persimmon (*Diospyros texana*), elbowbush (*Forestiera pubescens*), and netleaf forestiera (*Forestiera reticulata*).

The entrance to the cave is on a hillside and immediately opens into a passage measuring 75 feet long and 6 feet high. Sheetwash flows from the hill into the surface collapse area and infiltrates the cave. Most of the cave is considered a single large chamber separated into various rooms and passages by breakdown slabs. Madla's Cave is abnormally large for a cave in the Edwards Formation in Bexar County with a footprint roughly 200 feet in diameter (See Figure 28).

Biological collections and lists of fauna for Madla's Cave have been documented since 1962[10]. The data are compiled in Table AII-14. Red imported fire ants have not been observed in the area of the Madla's Cave Preserve. Protection of Madla's Cave would achieve the conservation of at least eleven troglobitic species. In addition, Madla's cave is the type location for the species *Rhadine infernalis* and *Cicurina madla*, first discovered there in October of 1963.

[9]Evaluation of Areas of Potential Influence on Karst Ecosystems for Certain Caves in Bexar County, Texas (part 1 of 2) revised 4 October 1996.

[10]Veni, Caves of Bexar County 2nd Edition, 1988.

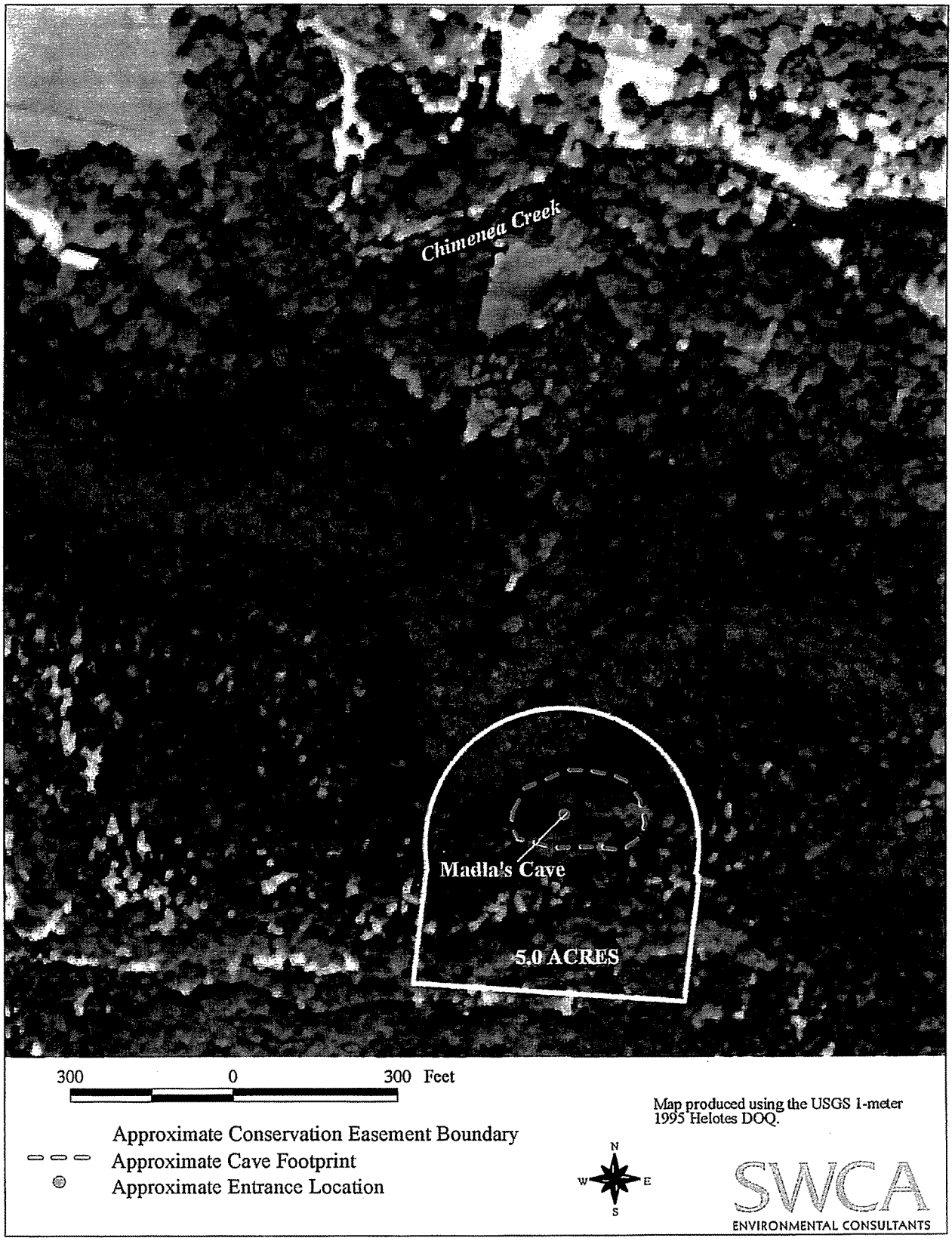


Figure 26. Madla's Cave Preserve Boundary, Vegetation and Adjacent Land Use.

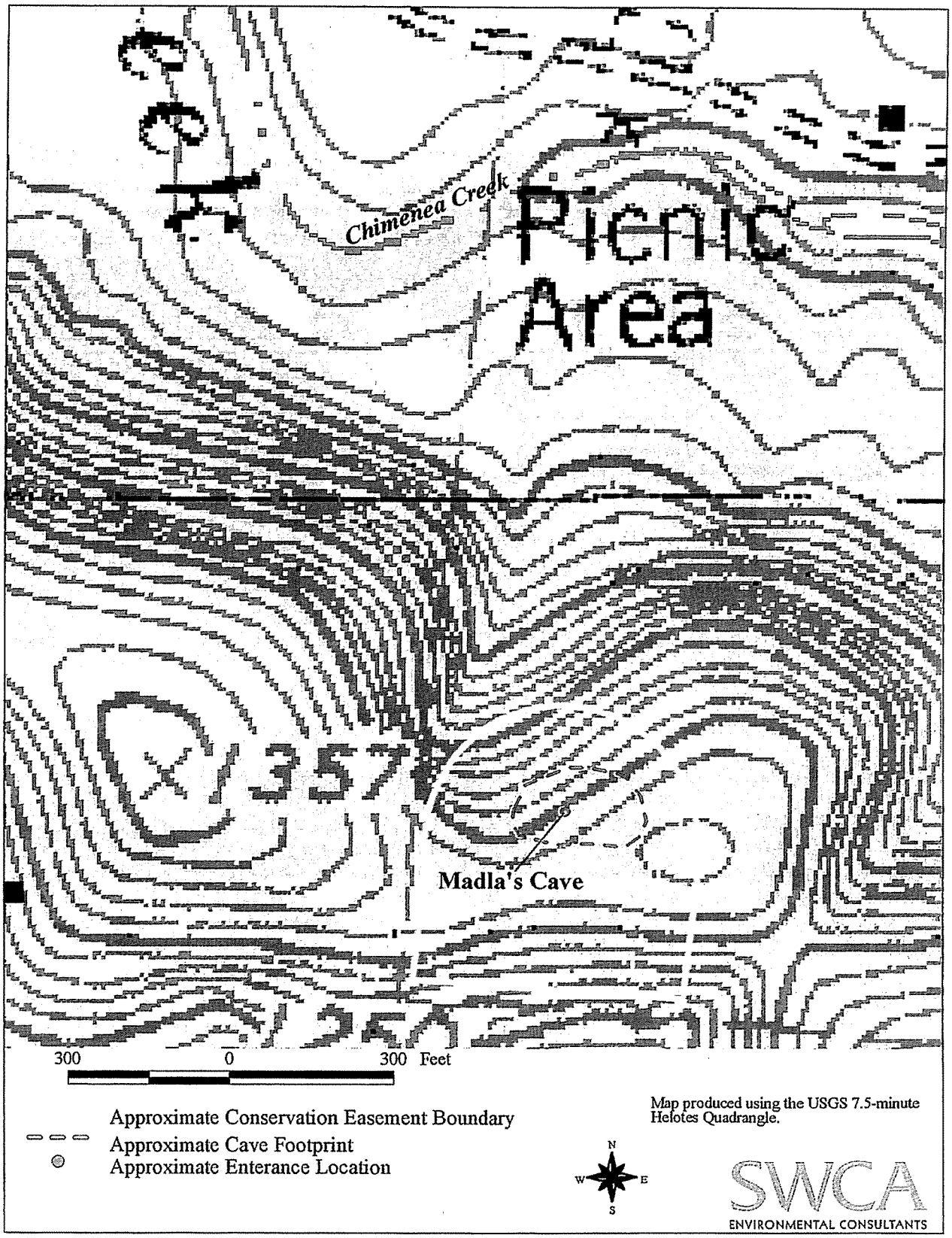


Figure 27. Topographic Map Showing Madla's Cave Preserve Boundary, Vegetation and Adjacent Land Use.

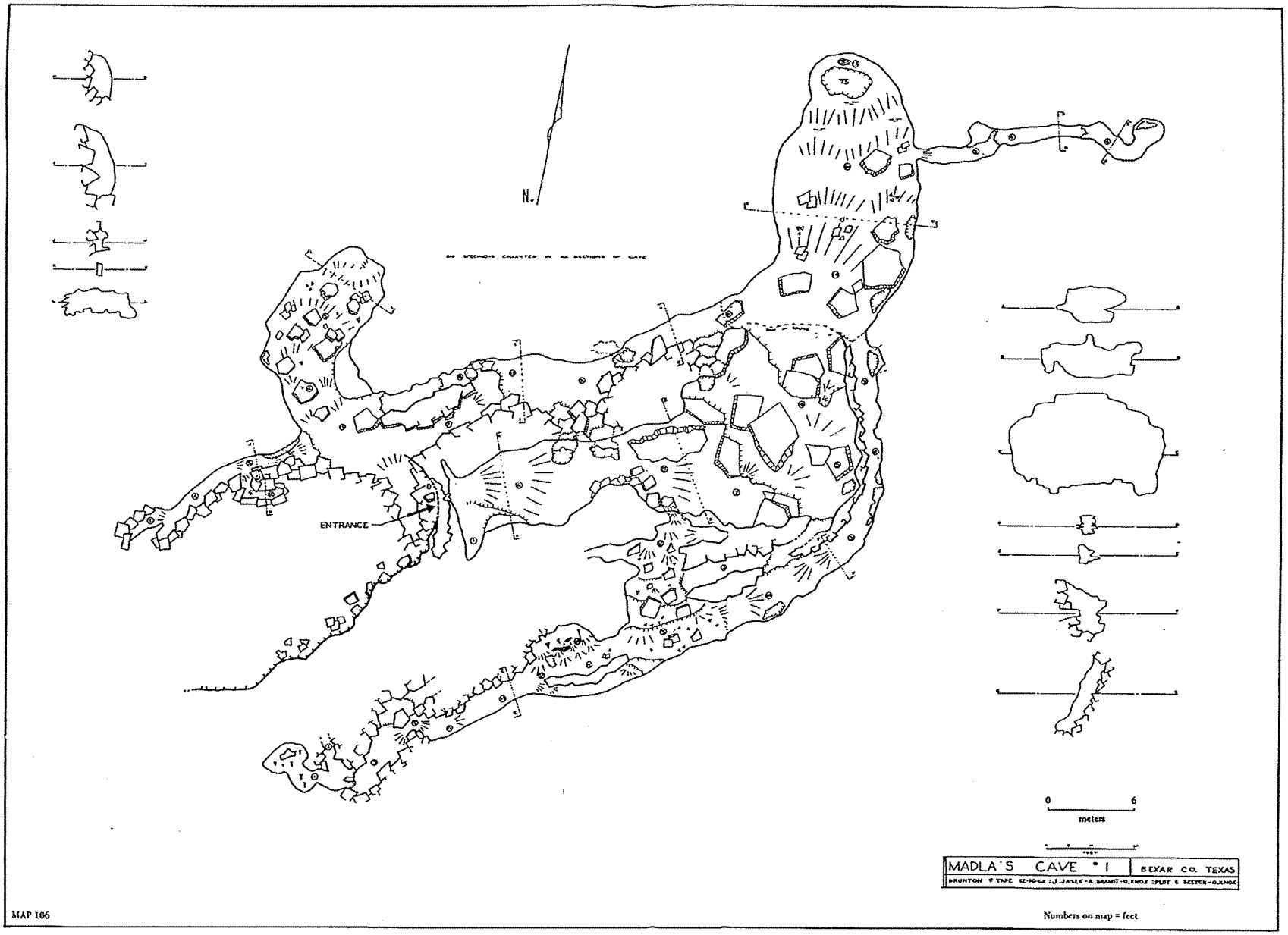


Figure 28. Madla's Cave Map.

Table AII-14. Biota of the Madla's Cave Preserve.[11]

Taxon encountered	Common Name
Bimastos sp.	earthworms
Brackenridgia cavernarum	troglobitic isopod
Cambala speobia	troglobitic millipede
Ceuthophilus sp.	cave cricket
Cicurina madla	eyeless troglobitic spider, endangered species
Cicurina varians	eyed troglobitic spider
Clivina sp.	ground beetle
Eidmannella rostrata	eyed troglobitic spider
Eustilicus condei	rove beetle
Hoplobunus madla	troglobitic harvestman
Hylactophryne augusti latrans	barking frog
Leiobunum townsendii	daddy longlegs
Myotis velifer incautus	Mexican brown bat
Pipistrellus sp.	bat
Plethodon glutinosus albagula	slimy salamander
Pseudosinella violenta	troglobitic springtail / collembolan
Rhadine infernalis	troglobitic ground beetle, endangered species
Texoreddellia texensis	troglobitic silverfish
Vaejovis reddelli	troglobitic scorpion

[11]Data complied from three reports 1) Veni, G. 1988. The Caves of Bexar County: Printed for the Texas Memorial Museum, Speleological Monographs, 2, 2) Reddell, J.R. 1997. The status and range of endemic arthropods from caves in Bexar County, Texas; and 3) Reddell, J.R. 1998. Troglobitic ground beetles of the genus Rhadine from Bexar County, Texas. A report for the Texas Parks and Wildlife Foundation.

PERMIT IMPLEMENTING AGREEMENT

by and between

LA CANTERA DEVELOPMENT COMPANY,

and the

U.S. FISH AND WILDLIFE SERVICE

This PERMIT IMPLEMENTING AGREEMENT ("Agreement"), made and entered into as of the 22nd day of October, 2001, by and among LA CANTERA DEVELOPMENT COMPANY (the "Permittee"), and the UNITED STATES FISH AND WILDLIFE SERVICE ("FWS" or the "Service"), hereinafter collectively called the "Parties," defines the Parties' roles and responsibilities and provides a common understanding of actions that will be undertaken to avoid, minimize, and mitigate the effects of the proposed development and operation of the "Property" (as defined below) on the subject species and their habitats.

1.0 Recitals

This Agreement is entered into with regard to the following facts:

WHEREAS, the Property has been determined to contain or be in the vicinity of the habitat for the federally listed troglobitic ground beetle, *Rhadine exilis,* and the Madla's Cave Meshweaver, *Cicurina madla*, both cave-dwelling invertebrates; and

WHEREAS, Permittee, with technical assistance from FWS, has developed a series of measures, described in the Habitat Conservation Plan (HCP), to avoid, minimize, and mitigate the potential effects of the development and operation of the Property upon the subject species and associated habitat; and

WHEREAS, the HCP provides for the establishment of a number of permanent karst or cave preserves within and outside the Property.

THEREFORE, the Parties hereto do hereby agree as follows:

2.0 DEFINITIONS

The following terms as used in this Agreement shall have the meanings set forth below:

2.1 The term "Permit" shall mean incidental take permit number TE-044512-0 issued by FWS to the Permittee pursuant to Section 10(a)(1)(B) of the Endangered Species Act (ESA)

2.2 The term "Property" shall mean the area consisting of approximately 1,000 acres generally bounded by I-10 to the east, Loop 1604 to the south, Babcock Road to the west, and Camp Bullis Road to the north in the City of San Antonio, Bexar County, Texas, as described and depicted on Exhibit A attached hereto.

2.3 The term "Permit Documents" shall mean the Permit, the HCP, this Agreement, the biological opinion issued by FWS in connection with the Permit, and such other documents as are attached to and agreed to be a part of the Permit.

2.4 The term "Permittee" shall mean La Cantera Development Company.

2.5 The terms "Conservation Plan" or "HCP" shall mean the Habitat Conservation Plan prepared by the Permittee and approved by FWS for the proposed Project.

2.6 The term "Covered Species" shall mean species so designated in the Permit.

2.7 The term "No Surprises Rule" shall mean the FWS regulation entitled "Habitat Conservation Plan Assurances ("No Surprises") Rule" published on February 23, 1998 at 63 Fed. Reg. 8859.

2.8 The terms "unforeseen circumstances" and "changed circumstances" shall have the same meanings as under the No Surprises Rule.

2.9 The term "Preserves" refers to the various karst and/or cave preserves identified in Appendix 1of the HCP, and to all associated "Preserve Facilities," including fencing, gates, barricades, and signage, to be constructed in connection with such Preserves.

2.10 The term "Participants" refers to purchasers of land within the Property who execute an "Agreement of Inclusion" and receive a "Certificate of Inclusion" in accordance with Section 14.0 of this Agreement.

2.11 The term "Management" refers to a third party, Service-approved conservation entity who will be responsible for operating, monitoring, and managing the preserves in perpetuity for the benefit of the Covered Species, as more specifically defined in Section 12.0 below.

3.0 HABITAT CONSERVATION PLAN

Pursuant to the provisions of Section 10(a)(1)(B) of the ESA, Permittee has prepared a Habitat Conservation Plan (HCP) and submitted it to FWS with a complete application, requesting a FWS Permit to allow Covered Species to be incidentally taken by activities within the Property. The HCP establishes an avoidance, minimization, and mitigation program for the subject Covered Species and their habitats.

4.0 INCORPORATION OF PERMIT DOCUMENTS

The Permit Documents are intended to be, and by this reference are, incorporated herein. In the event of any direct contradiction between the terms of this Agreement and the other Permit Documents, the terms of the Permit shall control. In all other cases, the terms of this Agreement and the terms of the Permit Documents shall be interpreted to be supplementary to each other.

5.0 LEGAL REQUIREMENTS

In order to fulfill the requirements that allow FWS to issue the Permit, the Permit Documents set forth measures that are intended to ensure that any take occurring within the Property will be incidental; that the impacts of the take will, to the maximum extent practicable, be minimized and mitigated; that procedures to deal with unforeseen circumstances will be provided; that adequate funding for the HCP will be provided; and that the incidental take will not appreciably reduce the likelihood of the survival and recovery of the Covered Species in the wild.

6.0 COOPERATIVE EFFORT

In order that each of the legal requirements as set forth in Paragraph 5.0 hereof are fulfilled, each of the Parties to this Agreement must perform various tasks as more particularly set forth in the HCP. Section 10(a)(1)(B) of the Endangered Species Act describes a cooperative program by Federal and private interests to avoid, minimize, and mitigate the effects of proposed actions on endangered species. Actions and limitations of obligations in the HCP shall be binding on the Parties to the same extent as if the HCP were set forth herein in its entirety.

7.0 TERMS USED

Terms defined and utilized in the HCP and the ESA shall have the same meaning when utilized in this Agreement, except as specifically noted.

8.0 PURPOSES

The purposes of this Agreement are:

8.1 To implement contractually the agreements, terms, conditions, and assurances, provided in the Permit Documents;

8.2 To describe remedies and recourse should any Party fail to perform its obligations, responsibilities, and tasks as set forth in this Agreement;

8.3 To provide a mechanism for purchasers of land within the Property to receive coverage under the Permit by the issuance of "Certificates of Inclusion."

9.0 TERM

This Agreement shall become effective on the date that FWS issues the Permit requested in the HCP and shall remain in full force and effect for a period of thirty (30) years or until termination of the Permit, whichever occurs sooner, provided, however, that the obligations of Permittee or Management, as applicable, with respect to establishment, operation, and maintenance of the Preserves shall be perpetual.

10.0 FUNDING

Subject to the limitations described in the HCP, Permittee will provide such funds as may be necessary to carry out its obligations under the HCP. The Permittee should notify the Service if the Permittee's funding resources have materially changed in a way that could affect the Permittee's ability to carry out its obligations under the Permit Documents, including a discussion of the nature of the change.

11.0 RESPONSIBILITIES OF THE PARTIES

11.1 Responsibilities of the Permittee

a. The HCP will be properly functioning if the terms of the Permit Documents have been or are being fully implemented in all material respects.

b. Subject to the limitations described in the HCP, the Permittee shall undertake all activities required of the Permittee in the HCP in order to meet the terms of the HCP and comply with the Permit.

c. The Permittee shall report any and all violations of the Permit and/or Permit Documents to FWS promptly upon detection.

d. The Permittee shall insure the transfer of the properties will be recorded with the county.

11.2 Responsibilities of FWS

FWS shall promptly and fully perform the actions contemplated to be performed by FWS under the HCP and this Implementing Agreement and will cooperate fully with the Permittee and Management in the implementation of the HCP; provided, however, that nothing in this Agreement shall require FWS to act in a manner contrary to the requirements of the Anti-Deficiency Act.

After issuance of the Permit, FWS may monitor the implementation thereof, including each of the terms of this Agreement and the HCP in order to ensure compliance with the Permit, the HCP, and this Agreement.

12.0 TRANSFER OF THE PRESERVES

The Permittee shall have the right, in the Permittee's discretion, from time to time to transfer and convey the Preserves, or any number thereof, to Management, including, without limitation, the following named entities that have been approved by FWS: Bexar County, The City of San Antonio, The Trust for Public Land, The Nature Conservancy, The Edwards Aquifer Authority, The Bexar Land Trust, The State of Texas, and/or any

other parties as may be hereafter approved by FWS as qualified to manage the preserves, for perpetual management, operation, and monitoring in substitution of the Permittees. The entities listed above by name have been identified by the Parties as having abilities and resources sufficient to operate, manage, and monitor the Preserves in accordance with the Permit and this HCP, and FWS has agreed that they would be acceptable permanent managers of the Preserves in place of the Permittee. FWS agrees that upon the request of the Permittee, FWS will promptly evaluate the qualifications of a proposed transferee other than those named above. A proposed transferee other than those named above must be approved by FWS prior to transfer and conveyance of the preserve(s). The Permittee shall promptly provide to FWS written notice of the conveyance and transfer of any of the Preserves, which notice shall include the name and contact information of Management transferee, a copy of the deed or other transfer instrument, a copy of the funding action and amount agreed upon, and a copy of a written agreement of the transferee to perform all obligations under the Permit with respect to the Preserve or Preserves in question. Such written agreement will name FWS as a third-party beneficiary with direct enforcement rights and will specify the "Total Funding Commitment" (as defined in Section 6.3.11 of the HCP) applicable to the Management transferee. The obligations of any Management transferee will be made binding covenants that run with the Preserve or Preserves in question. Failure of such notice of conveyance of a Preserve or Preserves and transfer to comply with the requirements of this Agreement shall constitute a breach of this Agreement and the Permit, curable by providing a conforming notice. Upon FWS's receipt of a conforming notice of conveyance and transfer, Management shall be deemed for all purposes to be the party responsible for operation, management, and monitoring of the Preserve or Preserves in question. The failure of Management to carry out such obligations under and in accordance with the Permit Documents shall subject Management to enforcement by FWS, but shall not be a basis for revocation, termination, or suspension of the authorization for development and operation of the Property pursuant to the Permit. Nothing contained in this Section 12.0 shall affect Permittee's obligation as described in Section 6.3.11 of the HCP to obtain FWS's approval of a "Total Funding Commitment" applicable to a Management transferee. Separation of the obligations of a pre-approved Management entity from the authorizations relative to development of the Property is based upon the size and capability of the pre-approved Management entities, the above requirement that they agree to be bound to perform all obligations under the Permit and the HCP with respect to the Preserve or Preserves in question, and in order to facilitate the transfer of the Preserves to these highly qualified and stable entities. FWS has determined that assumption of the management obligations by these entities, with direct right of enforcement by FWS, provides adequate assurance that the operation, management and monitoring obligations with respect to the Preserves will, in fact, be carried out. Notwithstanding anything contained herein to the contrary, to the extent Permittee may agree with a Management transferee to provide any funding to such Management transferee, such agreement shall be considered a binding obligation of Permittee hereunder.

13.0 REMEDIES AND ENFORCEMENT

13.1 Remedies in General

Except as set forth below, each Party shall have all remedies otherwise available to enforce the terms of this Agreement, the Permit, and the HCP, and to seek remedies for any breach hereof, subject to the following:

a. NO MONETARY DAMAGES

No Party shall be liable in damages to any other Party or other person for any breach of this Agreement, any performance or failure to perform a mandatory or discretionary obligation imposed by this Agreement, or any other cause of action arising from this Agreement. Notwithstanding the foregoing:

(1) Retain Liability

All Parties shall retain whatever liability they would possess for their present and future acts or failure to act without existence of this Agreement.

(2) Land Owner Liability

All Parties shall retain whatever liability they possess as an owner of interests in land.

(3) Responsibility of the United States

Nothing contained in this Agreement is intended to limit the authority of the United States government to seek civil or criminal penalties or otherwise fulfill its enforcement responsibilities under the ESA.

b. INJUNCTIVE AND/OR TEMPORARY RELIEF

The Parties acknowledge that injunctive and/or temporary relief may be appropriate to ensure compliance with the terms of this Agreement.

13.2 Permit Suspension or Revocation

Except as otherwise provided for under the terms of the Agreement, the Permit may be suspended or revoked only in conformance with the provisions of 50 CFR 13.27 through 13.29 (1999, as amended), as the same exists as of the date hereof.

13.3 Limitation and Extent of Enforceability

a. NO SURPRISES ASSURANCES

Pursuant to the provisions of the No Surprises Rule, this section 13.3a specifies certain assurances made by FWS to Permittee with respect to the Covered Species. FWS has found that the Covered Species are "adequately covered" (as such term is defined in the Rule) by the HCP. FWS agrees that the Covered Species shall be listed on the Permit as required by the Rule. Section 6.7 of the HCP contains a more detailed statement regarding the assurances provided to the Permittee and the procedure for evaluating the addition from time to time of species as Covered Species.

b. PRIVATE PROPERTY RIGHTS AND LEGAL AUTHORITIES AFFECTED

Except as otherwise specifically provided in the Permit Documents, nothing in this Agreement shall be deemed to restrict the rights of the Permittee to the use or development of those lands, or interests in lands, constituting the Property; provided, that nothing in the Permit Documents shall absolve the Permittee from such other limitations as may apply to such lands, or interests in lands, under other laws of the United States and the State of Texas.

14.0 ADDITIONAL PARTICIPANTS

It is expected that from time to time the Permittee will sell and convey portions of the Property to third-parties for their development, use, and occupation. In order to provide an efficient and effective means to assure that such third parties are obligated to comply with the relevant provisions of the Permit Documents and benefit from the authorizations granted in the Permit, FWS agrees that the Permittee, may, at the Permittee's election, issue to purchasers "Agreements of Inclusion" whereby they agree to be bound by and comply with those terms and conditions of the Permit applicable to the land they are purchasing within the Property. Sample forms of an Agreement of Inclusion and a Certificate of Inclusion are attached as Exhibits B and C to this Agreement. A purchaser signing an Agreement of Inclusion and receiving a Certificate of Inclusion in the substantially same forms as the samples provided in Exhibits B and C shall be referred to as a "Participant." FWS agrees that so long as the Permit remains in effect and a Participant is in compliance with the Agreement of Inclusion, that Participant shall be deemed, with respect to that Participant's property within the Property, to have with respect to that participant's property the full benefits and authorities of the Permit. FWS further agrees that in the event that, after the Preserves have been dedicated by appropriate legal mechanisms and Permittee or an approved Management transferee have agreed and irrevocably committed to provide funding up to the "Total Funding Commitment" described in Section 6.3.11 of the HCP, in the event that the Permit is suspended, terminated, or revoked for reasons not the fault of a Participant, and that

Participant is in compliance with the terms of its Agreement of Inclusion, FWS will issue to such Participant a permit conferring the same rights, benefits, and responsibilities with respect to the Participant's property as provided under the Permit, without additional requirements or conditions beyond those applicable to the Participant under its Agreement of Inclusion. FWS agrees that so long as Permittee utilizes reasonable efforts and diligence to cause Participants to comply with and perform their obligations under the applicable Agreements of Inclusion, a breach of those obligations or terms of the Permit or the HCP by a Participant will not be considered a violation by the Permittee of the Permit. In the event a Participant has materially breached its Agreement of Inclusion and, after reasonable notice and opportunity to cure, such Participant fails to cure, remedy, rectify, or adequately mitigate the effects of such breach, then Permittee may, and shall if so directed by FWS, terminate that Participant's Agreement of Inclusion.

The Permittee will submit copies of all Agreements and Certificates of Inclusion to the USFWS within 15 days of the last signature.

15.0 AMENDMENTS

Except as otherwise set forth herein, this Agreement may be amended consistent with the ESA and with the written consent of each of the parties hereto. FWS agrees to process requests for amendments in a timely manner. Reference is made to Section 6.9 of the HCP for additional provisions respecting amendment of this Agreement and the HCP. Amendments to the Agreement or any of the Permit Documents occurring subsequent to issuance of a Certificate of Inclusion to a participant shall in no way affect or impair that Participant's rights and obligations under its Agreement of Inclusion.

16.0 MISCELLANEOUS PROVISIONS

16.1 No Partnership

Except as otherwise expressly set forth herein, neither this Agreement nor the HCP shall make or be deemed to make any party to this Agreement the agent for or the partner of any other party.

16.2 Successors and Assigns

This Agreement and each of its covenants and conditions shall be binding on and shall inure to the benefit of the Parties hereto and their respective successors and assigns in conformance with the provisions of 50 CFR 13.25 (1999, as amended). Participants shall not be considered successors and assigns of Permittee solely by reason of their participation through an Agreement of Inclusion but shall have the rights as elsewhere set forth in this Agreement including Section 14 herewith.

16.3 Notice

Any notice permitted or required by this Agreement shall be delivered personally to the persons set forth below or shall be deemed given five (5) days after deposit in the United States mail, certified and postage prepaid, return receipt requested, and addressed as follows or at such other address as any Party may from time to time specify to the other Parties in writing:

Regional Director
United States Fish and Wildlife Service
Region 2, Room 4012
500 Gold Ave., S.W.
Albuquerque, NM 87102

with a copy to:

Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Compass Bank Building
Austin, Texas 78758
Attn: Field Supervisor

La Cantera Development Company
9830 Colonade Blvd., Suite 600
San Antonio, Texas 78230-2239
Attn: Mr. Glen E. Mitts

with a copy to:

USAA
9800 Fredericksburg Rd. (C3W)
San Antonio, TX 78288-0385
Attn: Kenneth W. Smith, Corporate Counsel

16.4 Entire Agreement

This Agreement, together with the Permit Documents, constitutes the entire Agreement between the Parties. It supersedes any and all other Agreements, either oral or in writing among the Parties with respect to the subject matter hereof and contains all of the covenants and Agreements among them with respect to said matters, and each party acknowledges that no representation, inducement, promise or Agreement, oral or otherwise, has been made by any other Party or anyone acting on behalf of any other Party that is not embodied herein. In the event of any direct contradiction between the terms of this Agreement and the other Permit Documents, the terms of the Permit shall control. In all other cases, the terms of this Agreement and the terms of the Permit Documents shall be interpreted to be supplementary to each other.

16.5 Elected Officials Not to Benefit

No member of or delegate to Congress shall be entitled to any share or part of this Agreement, or to any benefit that may arise from it.

16.6 Availability of Funds

Implementation of this Agreement and the HCP by FWS is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this Agreement will be construed by the parties to require the obligation, appropriation, or expenditure of any money from the U.S. Treasury. The parties acknowledge that FWS will not be required under this Agreement to expend any Federal agency's appropriated funds unless and until an authorized official of that agency affirmatively acts to commit to such expenditures as evidenced in writing.

16.7 Multiple Originals

This Agreement may be executed in any number of multiple originals. A complete original of this Agreement shall be maintained in the records of each of the Parties hereto.

16.8 Third-Party Beneficiaries

Without limiting the applicability of the rights granted to the public pursuant to the provisions of 16 U.S.C. §1540(g), this Agreement shall not create any right or interest in the public, or any member thereof, as a third party beneficiary hereof, nor shall it authorize anyone not a Party to this Agreement to maintain a suit for personal injuries or property damages pursuant to the provisions of this Agreement. The duties, obligations, and responsibilities of the Parties to this Agreement with respect to third parties shall remain as imposed under existing Federal or State law.

16.9 Relationship to the ESA and Other Authorities

The terms of this Agreement shall be governed by and construed in accordance with the ESA and other applicable laws. In particular, nothing in this Agreement is intended to limit the authority of FWS to seek penalties or otherwise fulfill its responsibilities under the ESA. Moreover, nothing in this Agreement is intended to limit or diminish the legal obligations and responsibilities of the FWS as an agency of the Federal government.

16.10 Reference Regulations

Any reference in this Agreement or the Permit Documents to any regulation or rules of FWS, (except for any reference to the No Surprises Rule which shall be deemed to be the No Surprises Rule in effect as of the effective date of this Agreement,) shall be deemed to be a reference to such a regulation or rule in existence at the time an action is taken.

16.11 Applicable Laws

All activities undertaken pursuant to this Agreement, the HCP, the Permit, and all other Permit Documents must be in compliance with all applicable State and Federal laws and regulations.

16.12 Dispute Resolution

The Parties will cooperate in good faith to achieve the objectives of this Agreement and to avoid disputes. The parties will exert their best efforts to resolve disputes at the lowest organizational level before elevating the dispute to the appropriate officials within their respective organizations.

IN WITNESS WHEREOF, THE PARTIES HERETO have executed this Implementing Agreement to be in effect as of the date last signed below.

UNITED STATES FISH AND WILDLIFE SERVICE

By: _____ Date: 10/22/01
Regional Director
Albuquerque, New Mexico

LA CANTERA DEVELOPMENT COMPANY

By: _____ Date: October 12, 2001
Name: Glen E. Mitts
Title: Vice-President

STATE OF NEW MEXI(§
§
COUNTY OF Bernalillo §

This instrument was acknowledged before me on this 22 day of October, 2001, by Nancy M. Kaufman, Regional Director, of the United States Fish and Wildlife Service of the Department of the Interior of the United States of America.

OFFICIAL SEAL
Donna M. Shoemaker
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 6/3/2002

Donna M. Shoemaker
Notary Public Signature

(PERSONALIZED SEAL)

STATE OF TEXAS §
§
COUNTY OF BEXAR §

This instrument was acknowledged before me on this 24th day of October, 2001, by Glen E. Mitts, Vice-President of La Cantera Development Company, a Delaware corporation on behalf of said corporation.

PATRICIA L. DAMON
Notary Public
State of Texas
My Comm. Exp. 12-18-2001

Patricia L. Damon
Notary Public Signature

(PERSONALIZED SEAL)

Exhibits:
A: Property
B: Agreement of Inclusion
Attachment A
Attachment B
C: Certificate of Inclusion

EXHIBIT A TO THE IMPLEMENTING AGREEMENT

EXHIBIT B TO THE IMPLEMENTING AGREEMENT

Agreement of Inclusion

AGREEMENT OF INCLUSION

COUNTY OF BEXAR §
§
STATE OF TEXAS §

RECITALS

The Bexar County region of South-Central Texas is home to several species of karst invertebrates listed as endangered under the federal Endangered Species Act of 1973, as amended, 16 U.S.C. § 1531, et seq. ("ESA").

In order to obtain authorization for potential impacts to listed karst invertebrates in connection with construction and operation of the master planned development in San Antonio, Bexar County, Texas known as "La Cantera", La Cantera Development Company applied for a permit under Section 10(a)(1)(B) of the ESA. The United States Fish and Wildlife Service ("USFWS") issued Permit Number TE-044512-0 (the "Permit"), to the La Cantera Development Company on _____, 2001.

Pursuant to provisions of that certain Permit Implementing Agreement dated _____, 2001, by and between La Cantera Development Company and USFWS (the "Implementing Agreement"), in exchange for committing to the implementation of various conservation measures described in the Permit and the associated La Cantera Habitat Conservation Plan (the "La Cantera HCP"), La Cantera Development Company is authorized to assign certain Permit inclusion rights (hereinafter referred to as "Inclusion Rights") to purchasers of land within the area covered by the Permit ("Participants"). Through inclusion in the La Cantera HCP, Participants are considered covered by the Permit to the extent and as provided in the Implementing Agreement.

AGREEMENT

This La Cantera Habitat Conservation Plan Inclusion Agreement is entered into this ___ day of 20___, by and between _____, hereinafter referred to as "Participant" or "Assignee," and La Cantera Development Company, hereinafter referred to as "LCDC."

For and in consideration of the mutual covenants and considerations set forth herein, LCDC and Participant hereby agree with respect to the assignment of certain Inclusion Rights as provided by the Permit and the Implementing Agreement as follows:

ARTICLE I.
PARTICIPANT'S PROPERTY

Participant is the owner of a tract or tracts of land consisting of approximately _____ acres situated within the property covered by the Permit in Bexar County, Texas, and more fully described and depicted in Attachment A (the "Participant's Property").

ARTICLE II.
ASSIGNMENT OF INCLUSION RIGHTS

LCDC hereby assigns unto Participant certain Inclusion Rights for the exclusive use and benefit of Participant's Property. These Inclusion Rights are assigned to the Participant for their use and benefit only with respect to the Participant's Property and in connection with the issuance of the Permit for the La Cantera HCP pursuant to Section 10(a)(1)(B) of the Endangered Species Act, 16 U.S.C. § 1531, et seq. The term "Inclusion Rights" shall mean and refer to any and all authorizations, benefits, rights, credits, offsets, or other privileges or entitlements that may be utilized by Participants in conjunction with the La Cantera HCP Permit relating to the existence, dedication, conservation, maintenance, or preservation of the species of karst invertebrates covered by the Permit.

This assignment is expressly made subject to the provisions and requirements of the Endangered Species Act of 1973, as amended, 16 U.S.C. § 1531, et seq.; Title 50 of the Code of Federal Regulations, including Parts 13, 17, and 21; the Permit; and the La Cantera HCP as provided by the Permit and including the conditions and requirements provided in the La Cantera HCP.

ARTICLE III.
CONSIDERATION

For and in consideration of its assignment of these Inclusion Rights, the Participant has paid to LCDC $10.00 and given other good and valuable consideration.

ARTICLE IV.
ADDITIONAL RESPONSIBILITIES OF PARTICIPANT; SPECIAL TERMS

For and in consideration of the assignment of Inclusion Rights, the Participant agrees that they shall comply with the terms and conditions of this Agreement and those special conditions approved by USFWS and set forth in Attachment B, attached hereto and incorporated herein for all purposes. Participants shall provide any assistance to LCDC necessary or appropriate to allow LCDC to comply with the Permit, such as providing information relative to the Participant's Property that may be required for any reports to USFWS

ARTICLE V.
BREACH BY PARTICIPANT

In the event of a breach of this Agreement by Participant, LCDC shall have the right, after providing Participant reasonable notice and opportunity to cure, remedy, rectify, or mitigate the effects of such breach, to pursue any and all remedies that may be available to LCDC at law, in equity, or both, which remedies shall, in the case of a material breach of this Agreement by Participant, include the right to terminate this Agreement. Notification of breach shall be made by LCDC to the Participant in writing at the address provided in ARTICLE XI below.

ARTICLE VI.
OBLIGATIONS OF LCDC

LCDC shall comply with the terms of the Permit and take such actions as are necessary to maintain the effectiveness of the Permit.

Notwithstanding anything to the contrary herein, LCDC shall not be responsible to, nor liable to, Participant for any damages resulting from any rules, regulations, action(s), or inaction(s) by the U.S. Department of the Interior and/or the U.S. Fish and Wildlife Service promulgated or taken on or after the date of this Agreement that would in any way impair or render ineffective, either partially or in its entirety, any or all benefits to the Participant's Property that accompany the assignment of the Inclusion Rights herein.

ARTICLE VII.
COVENANTS RUN WITH THE LAND: RECORDATION

Participant agrees that promises and covenants provided herein are intended to be binding upon any heirs, successors, and assigns in interest to the Participant's Property. Upon any transfer of any ownership rights to all or part of the Participant's Property, this Agreement shall not terminate, but rather shall continue in full force and effect and shall be fully binding upon any heirs, successors, and assigns in interest to the Participant's Property, or any portion thereof. Upon execution of this agreement by LCDC and Participant, this Agreement shall be acknowledged and recorded in the Real Property Records of Bexar County, Texas.

ARTICLE VIII.
VENUE AND CHOICE OF LAW

The obligations and undertakings of each of the parties to this Agreement shall be performable in Bexar County, Texas, and this Agreement shall be governed by and construed in accordance with the laws of the State of Texas.

ARTICLE IX.
MODIFICATION

Any oral representations or modifications concerning this Agreement shall be of no force or effect, excepting a subsequent modification in writing signed by the party to be charged and expressly approved by an authorized representative of such party.

ARTICLE X.
SUCCESSORS AND ASSIGNS

This Agreement shall be binding upon and inure to the benefit of the successors and assigns of the respective parties hereto, where authorized pursuant to this Agreement.

ARTICLE XI.
NOTICE

Any notice to be given hereunder by either party to the other shall be in writing and may be effected by personal delivery in writing, or registered or certified mail, return receipt requested, when mailed to the proper party, at the following addresses:

PARTICIPANT:

_____
_____
_____

LCDC:

La Cantera Development Company
9830 Colonnade Blvd., Suite 600
San Antonio, Texas 78230-2239

with a copy to:

Corporate Counsel
9800 Fredericksburg Rd. (C3W)
San Antonio, TX 78288-0385

Each party may change the address for notice to it by giving notice of such change in accordance with the provisions of this paragraph.

ARTICLE XII.
TERM OF AGREEMENT

This Agreement shall terminate upon the expiration or termination of the Permit, or on _____, whichever is sooner.

ARTICLE XIII.
HEADINGS

The headings at the beginning of the various provisions of this Agreement have been included only in order to make it easier to locate the subject covered by each provision and are not to be used in construing this Agreement.

ARTICLE XIV.
NUMBER AND GENDER DEFINED

As used in this Agreement, whenever the context so indicates, the masculine, feminine, or neutral gender and the singular or plural number shall each be deemed to include the others.

ARTICLE XV.
MULTIPLE COUNTERPARTS

This Agreement may be executed in multiple counterparts, each of which shall constitute a duplicate original hereof, but all of which together shall constitute one and the same instrument.

ARTICLE XVI.
TIME OF ESSENCE

Time is of the essence in the Agreement.

EXECUTED AS OF THE LAST DAY SET FORTH BELOW.

LCDC:	**PARTIC1PANT:**
LA CANTERA DEVELOPMENT COMPANY	_____
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____
Date: _____	Date: _____

ACKNOWLEDGEMENTS

STATE OF TEXAS §
§
COUNTY OF BEXAR §

This instrument was acknowledged before me on this ____ day of _____, 200__, by _____, _____ of La Cantera Development Company, a Delaware corporation on behalf of said corporation.

_____
Notary Public Signature

(PERSONALIZED SEAL)

STATE OF TEXAS §
§
COUNTY OF BEXAR §

This instrument was acknowledged before me on this ____ day of _____, 200__, by _____, _____ of _____, a _____ corporation on behalf of said corporation.

_____
Notary Public Signature

(PERSONALIZED SEAL)

Attachment A to the Agreement of Inclusion
(Legal Description of Participant's Property and Map)

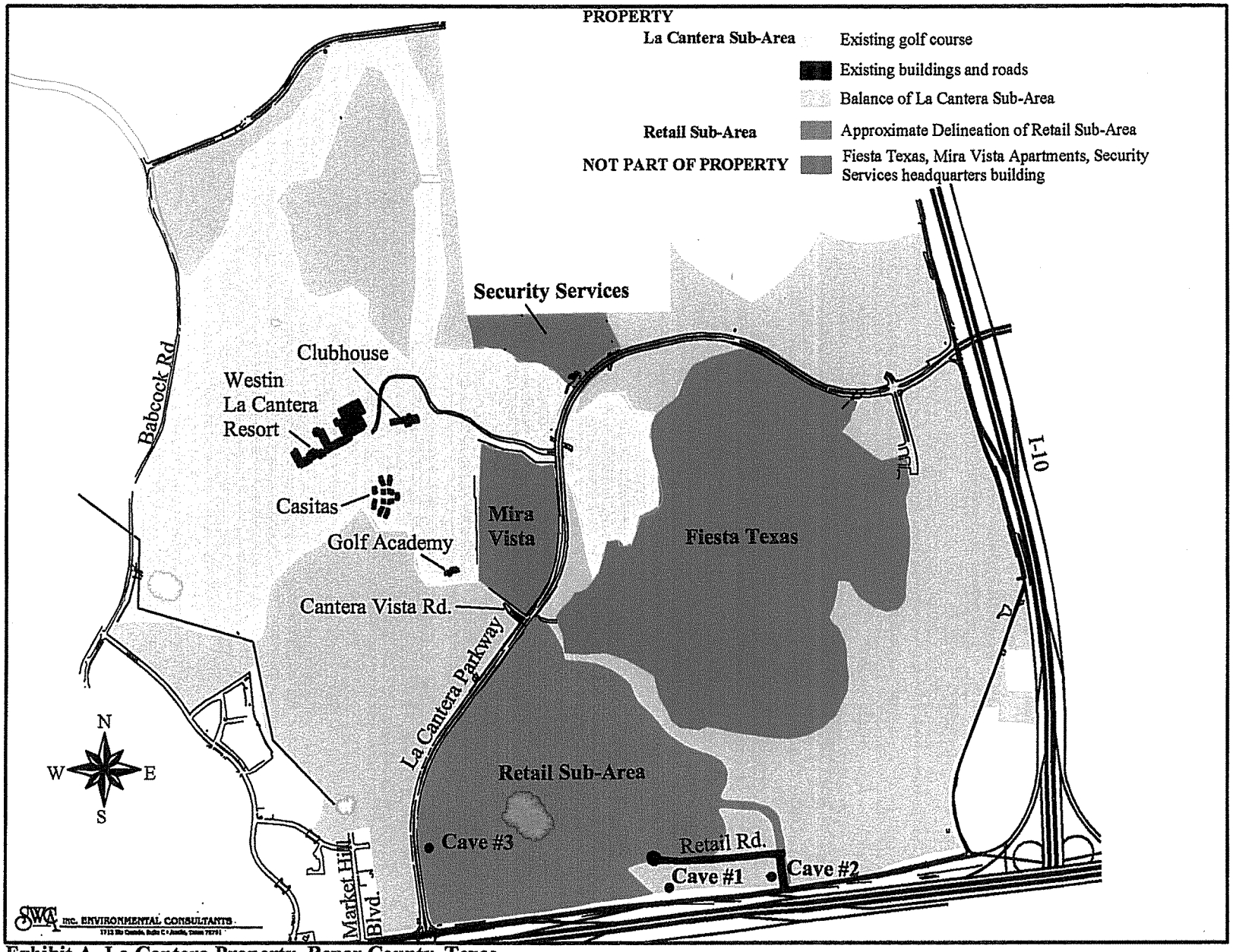


Exhibit A. La Cantera Property, Bexar County, Texas.

1. An integrated pest management program (IPM), including consideration of fire ants, shall be adopted prior to any construction or clearing activities on the Participant's Property and will be implemented by the Participant. The goal of the IPM is to minimize chemical use, including pesticides and fertilizers, while still maintaining a natural balance.

2. Drainage from developed areas shall be channeled into curbed roadways or other confined drainages, into non-permeable detention basins and/or discharged off-site away from the recharge zone, and diverted away from the two one-acre preserves for La Cantera Caves 1 and 2 (the "Preserves").

3. Utility lines including sewer and water will not be placed within the Preserves.

4. The Participant will prohibit the use of deer feeders and birdseed feeders in residential yards within 500 ft of the Preserves through deed restrictions.

5. Construction period erosion and siltation management will meet at a minimum City of San Antonio and TNRCC code requirements and protocols for storage, use and spill containment and countermeasures for construction-related chemical and petroleum products.

6. Construction of all wastewater pipelines will be at least as protective as current TNRCC aquifer protection rules.

7. If any caves or subterranean voids are encountered during construction the Participant will have a qualified geologist respond immediately to evaluate the void geologically and issue specific instructions in accordance with standard practices accepted by Texas Natural Resource Conservation Commission, as applicable, for the immediate closing of the void and the resumption of the work. Construction activity may resume immediately upon closing or filling of the void.

[If Participant's Property lies within the boundaries of La Cantera Parkway, Loop 1604, and IH 10, then the following conditions will also apply:]

8. The following uses that have a significant potential to contaminate sub-surface karst and/or groundwater shall be prohibited on the Participant's Property: gas stations, dry cleaners (on-site cleaning process), metal or chemical processing or manufacturing facilities, hazardous waste facilities, and septic tanks plus any other uses prohibited by the TNRCC or the City of San Antonio. Storage of emergency supplies of fuel such as for auxiliary generators for commercial buildings shall be permitted in compliance with applicable Federal, State and local laws.

9. Gas and oil shall not be stored on the Participant's Property; provided, however, that small amounts may be stored such as for emergency power generators.

EXHIBIT C TO THE IMPLEMENTING AGREEMENT

Certificate of Inclusion

LA CANTERA HABITAT CONSERVATION PLAN CERTIFICATE OF INCLUSION

The following tract or parcel of land_____ _____(tract address, tax parcel id #, and size of tract), has complied with requirements of the federal Endangered Species Act (16 U.S.C. §1531 et seq.) through participation under Endangered Species Act Section 10(a)(1)(B) Permit Number TE-044512-0 issued by the U.S. Fish and Wildlife Service to the La Cantera Development Company on _____, 2001. _____ (owner's name) entered into an Agreement of Inclusion with La Cantera Development Company on . Said Agreement is recorded in the Real Property Records of Bexar County, Texas. Participation in the La Cantera Habitat Conservation Plan is subject to the terms and conditions of such Agreement.

Certificate Issued By La Cantera Development Company to _____ on _____, 20_____.

LA CANTERA DEVELOPMENT COMPANY

By: _____

Name: _____

Title: _____

This Certificate of Inclusion or a facsimile must be posted at the Participant's Property from the time vegetation clearing begins until construction is completed. For residential development, completed construction is when all roads and utilities are completed to the extent that they meet the applicable acceptance criteria of the City of San Antonio or Bexar County. For commercial/industrial/multi-family developments, completed construction is when buildings are suitable for occupancy. For more information about the certificate, agreement, or the permit contact: La Cantera Development Company, 9830 Colonnade Blvd., Suite 600, San Antonio, Texas 78230. For information about the participating tract contact:

_____

(On the lines above, the participant must provide the name, address, and telephone of the responsible party for the participating tract)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
10711 Burnet Road, Suite 200
Austin, Texas 78758
(512) 490-0057

In Reply
Refer To:
FWS/AFO

MEMORANDUM

TO: Regional Director, Region 2

FROM: for William Seawell
Field Supervisor, U.S. Fish and Wildlife Service, Austin Office

SUBJECT: Biological Opinion for La Cantera Development Company 10(a)(1)(B) Permit TE-044512-0 in San Antonio, Bexar County, Texas

This provides the U.S. Fish and Wildlife Service's (Service) biological opinion regarding proposed issuance of a section 10(a)(1)(B) permit under authority of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Federal action under consideration is issuance of a permit authorizing incidental take of the federally-listed endangered *Rhadine exilis, Rhadine infernalis* (no common names), and *Cicurina madla* (Madla Cave meshweaver). La Cantera Development Company (Applicant) has submitted an application (TE-044512-0) for an incidental take permit under the Act to take the above federally-listed karst invertebrates within the approximately 1,000 acre tract (Property). The Environmental Assessment/Habitat Conservation Plan (EA/HCP) has been reviewed for mitigation acceptability. Implementing regulations for section 10(a)(1)(B) of the Act, as provided for by 50 CFR 17.22, specify criteria by which a permit allowing incidental "take" of listed endangered species pursuant to otherwise lawful activities may be obtained. Purpose and need for a section 10(a)(1)(B) permit is to ensure that incidental take resulting from proposed construction will be minimized and mitigated to the maximum extent practicable, and will not appreciably reduce the likelihood of survival and recovery of these federally-listed endangered species in the wild.

Consultation Chronology

In 1994, the Service began discussions with a coalition of landowners, developers, and other interested parties, in which the Applicant was included, about creating a conservation agreement that might preclude the need for listing these species. We continued working with interested parties to develop a conservation strategy and agreement. The issues that needed to be addressed in a conservation agreement related primarily to determining the needs for the species'

conservation, responsibility and commitment for implementation and funding, and the amount of time required to implement the conservation measures. In January 1999, we provided a handout titled "Criteria and Measures for Long-term Conservation of Karst Invertebrates in Bexar Co., TX," to the coalition as a guide for conservation of species-inhabited caves. However, actions to sufficiently reduce threats to the species were not occurring, and thus, the Service listed the nine Bexar County karst invertebrates on December 26, 2000.

In August of 2000, the Applicant was aware that the listing was imminent, and decided to pursue an incidental take permit for their proposed project. Therefore, discussions began on the impacts that were proposed and the mitigation that would be acceptable. The Applicant submitted its first karst mitigation proposal in October of 2000. On February 27, 2001, we sent a letter to La Cantera outlining our understanding of their proposed project and what would be necessary for mitigation in order to receive a permit.

On May 24, 2001, the Applicant submitted an application for a section 10(a)(1)(B) permit. Included was a habitat conservation plan (HCP) with supporting documents. These documents included several years of studies on the caves found on- and off-site. Information included hydrogeologic studies, cave profiles, species identification, flow patterns, and the development plan to include on-site setbacks around two of the three caves and 179 acres of proposed off-site karst preserves.

On July 2, 2001, the Service published a Federal Register notice of availability of the EA/HCP and receipt of application for the incidental take permit for the Applicant's proposed project. The comment period was for 60 days and closed on August 31, 2001.

A. BIOLOGICAL OPINION

I. Description of Proposed Action

The action involves issuance of a section 10(a)(1)(B) permit to the Applicant for new development within a master planned development in San Antonio, Bexar County, Texas (Figure 1). Existing development, which is not covered by the proposed permit, includes the Westin La Cantera Resort and Golf Club, the Mira Vista Apartment complex, Security Service Federal Credit Union headquarters building , La Cantera Parkway, Retail Road, Cantera Vista Road, and Fiesta Texas (Figure 2). The subject property totals approximately 1,000 acres, of which the majority will be developed for the purpose of commercial and residential facilities, associated streets and utilities. Much of the Property has been historically grazed and cleared of trees and brush. The southern boundary of the Property is adjacent to Loop 1604, a heavily traveled four-lane highway with both east- and west-bound frontage roads. The Property is bounded to the north and west by residential development. The eastern boundary is adjacent to I-10, a heavily traveled, six-lane interstate with both north- and south-bound frontage roads.

The Applicant's proposal includes seven karst preserves totaling 181 acres to be protected in perpetuity. The karst preserves include one-acre on-site set-backs for La Cantera Caves #1 and

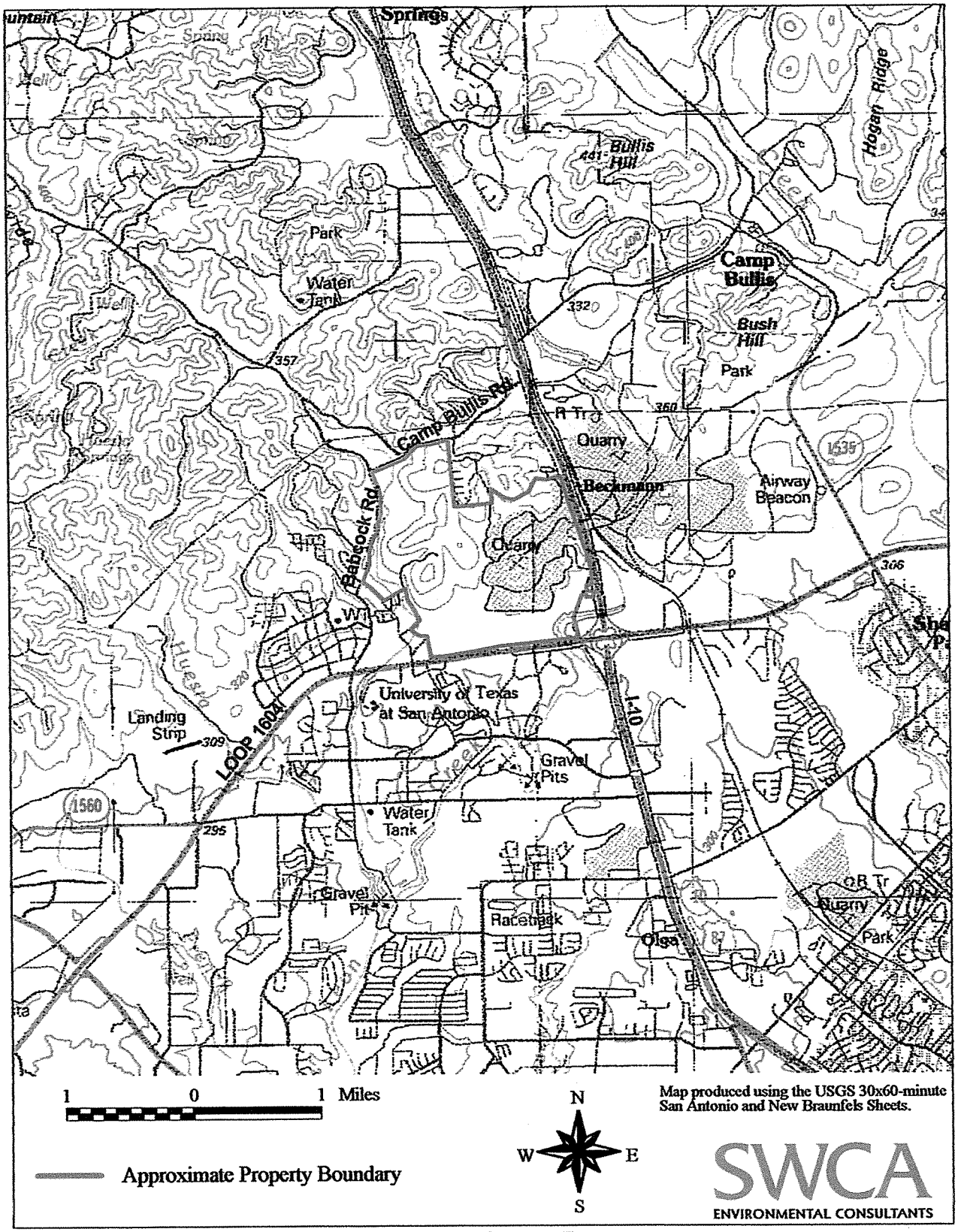


Figure 1. Location of La Cantera Property, Bexar County, Texas.

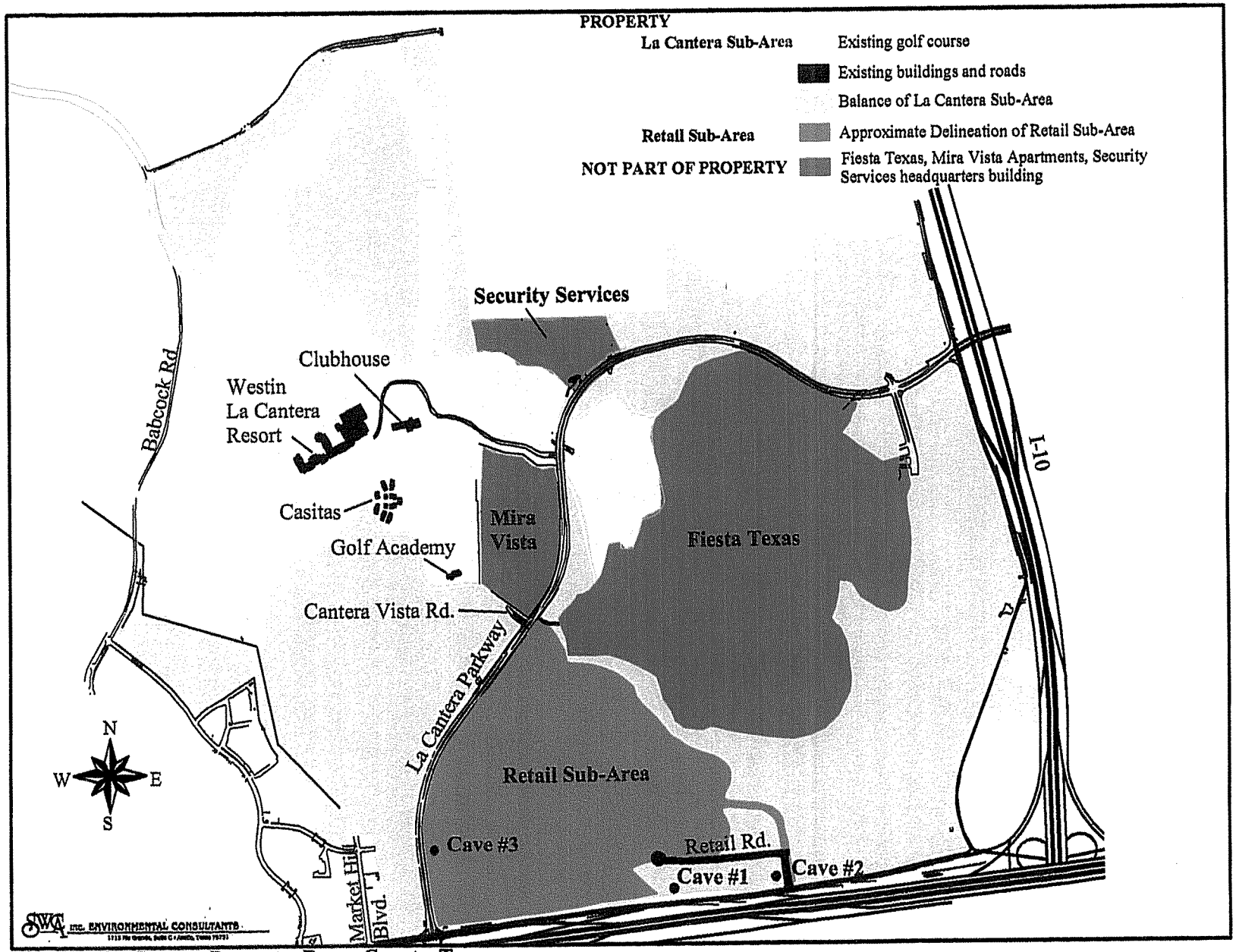


Figure 2. La Cantera Property, Bexar County, Texas.

#2, and five off-site preserves totaling approximately 179 acres. Off-site preserves include: an approximately 5-acre area encompassing Madla Cave; an approximately 4-acre area encompassing John Wagner Ranch Cave #3; approximately 70 acres encompassing Hills and Dales Pit; approximately 25 acres encompassing Helotes Hilltop and Helotes Blowhole caves; and approximately 75 acres on the Canyon Ranch property that encompasses Scenic Overlook, Canyon Ranch Pit, and Fat Man's Nightmare caves. All of the off-site karst preserves contain endangered karst invertebrate species, as well as other cave-adapted species. A summary of endangered invertebrate species known, and how the identifications of each species were verified, from each of the proposed on- and off-site preserve caves is provided in Table 1 (also see the HCP). The off-site mitigation preserves contain four caves total with *R. exilis*, in three preserves (two in the UTSA region and one in the Helotes region); eight total caves with *C. madla*, in five preserves (two in the UTSA region, two in the Helotes region, and one in the Government Canyon region); and six total caves for *R. infernalis*, in four preserves (one in the UTSA region, two in the Helotes region, and one in the Government Canyon region). The *C. madla* locations include three of the eight confirmed locations for this species.

Undeveloped portions of the Property will be monitored and treated for introduced fire ants; use of pesticides and herbicides will be restricted; and use of the premises for businesses that have the potential to contaminate sub-surface karst and/or groundwater, such as gas stations and dry cleaners will be prohibited. The off-site preserves will be monitored and managed for the species and will incorporate adaptive management.

Additionally, the Applicant will provide $20,000 to The Nature Conservancy of Texas towards outreach efforts with the goal of raising awareness, understanding, and appreciation for Bexar County endangered karst invertebrates. The Applicant will also provide to the Service, three times a year for three years, printouts of northern Bexar County multi-layered maps to include the following layers: karst fauna regions, karst zones, updated plats, and land use types. The Applicant will also fund genetics studies by Dr. Marshall Hedin, San Diego State University. These studies will be designed to provide techniques for definitive species level identification of immature specimens of eyeless *Cicurina* spiders in northern Bexar County.

The Implementing Agreement signed in connection with the HCP will establish a process for the issuance of "Certificates of Inclusion" to purchasers of portions of the Property upon such purchasers signing "Agreements of Inclusion." This procedure is to allow an efficient mechanism to assign the benefits of the permit and to ensure the implementation of the HCP. These procedures are detailed in the Implementing Agreement.

The Applicant stated in its HCP that its parent company USAA through the USAA Foundation previously contributed $100,000 to the acquisition of approximately 700 acres to add to Government Canyon State Natural Area "to enhance conservation opportunities for Bexar County karst invertebrates and Edwards Aquifer water quality." As of this date, the Service is not aware of any listed karst invertebrates being located on this property.

Table 1. Summary of Endangered Species Known to Occur in Subject Caves. [* = Type locality]

Preserve	Cave	Size in Acres	Endangered and Other Species Present	Basis of Identification	Karst Region
Property	Cave #1	1	*Rhadine exilis*	Kingsley, Grubbs (SWCA) 1994, 1995. Reddell, J.R. 1998, Troglobitic Ground Beetles of the Genus *Rhadine* from Bexar County, Texas. Reddell: 2000; sample codes 2002, 2004.	UTSA
			Cicurina sp. (eyeless)	Kingsley, Grubbs (SWCA): 1994, 1995. Cokendolpher: 2000; sample codes 2001, Cave 1.	
	Cave #2	1	*Rhadine exilis*	Kingsley, Grubbs (SWCA): 1994, 1995.	
			Cicurina sp. (eyeless)	Kingsley, Grubbs (SWCA): 1994, 1995	
Madla Cave	Madla Cave	5	*Cicurina madla** *Rhadine infernalis**	Texas Memorial Museum Speleological Monographs, 3 Studies on the Cave and Endogean Fauna of North America II, and The Caves of Bexar County, Second Edition, Reddell, J.R. 1998, Troglobitic Ground Beetles of the Genus *Rhadine* from Bexar County, Texas.	Helotes
John Wagner Ranch Cave #3	John Wagner Ranch Cave #3	4	*Rhadine exilis** *Rhadine infernalis* *Cicurina* sp. (eyeless) *Texella* sp. *Neoleptoneta* sp.	Texas Memorial Museum Speleological Monographs, 3 Studies on the Cave and Endogean Fauna of North America II, and The Caves of Bexar County, Second Edition, Reddell, J.R. 1998, Troglobitic Ground Beetles of the Genus *Rhadine* from Bexar County, Texas.	UTSA
Hills and Dales Pit	Hills and Dales Pit	70	*Rhadine exilis*	Reddell: 2000; sample code 5002.	UTSA
			Cicurina madla	Cokendolpher: 2000; sample code 5001.	
			Texella sp.	Reddell: 2000; no sample code. Cokendolpher: 2000; sample code 5001.	
			Neoleptoneta sp.	Cokendolpher: 2000; sample code 5001.	
Helotes Hilltop / Helotes Blowhole	Helotes Hilltop Cave	25	*Batrisodes venyivi**	Texas Memorial Museum Speleological Monographs, 3 Studies on the Cave and Endogean Fauna of North America II,	Helotes
			Rhadine exilis	SWCA (White, Bechtol) 2000.	
			Cicurina sp. (eyeless)	SWCA (Kingsley, Grubbs, White) 1999.	
	Helotes Blowhole Cave		*Rhadine exilis*	SWCA (Kingsley, Grubbs, White) 1999.	
			Rhadine infernalis	Reddell, J.R. 1998, Troglobitic Ground Beetles of the Genus *Rhadine* from Bexar County, Texas.	
			Cicurina madla.	Cokendolpher 2001: (unpublished text cites specimen collected by Grubbs, Kingsley, White of SWCA).	
Canyon Ranch	Scenic Overlook Cave	75	*Rhadine infernalis*	Reddell 2000: Sample code 2401.	Government Canyon
			Batrisodes venyivi	Reddell 2000: Sample code 2402.	
			Cicurina sp. (eyeless)	Cokendolpher 2000: Sample code 2101.	
			Texella sp.	Reddell 2000: Sample code 2404.	
	Fat Man's Nightmare Cave		*Rhadine infernalis*	Reddell 2000: Sample code 2301.	
			Cicurina sp. (eyeless)	SWCA (White) 2000.	
			Texella sp.	SWCA (White) 2000.	
	Canyon Ranch Pit		*Rhadine infernalis*	Sight Record, SWCA (White) 2000.	
			Cicurina sp. (eyeless)	SWCA (White) 2000.	

Following are the proposed permit terms and conditions:

A. General conditions set out in subpart D of 50 CFR 13, and specific conditions contained in Federal Regulations cited in Block #2 above, are hereby made a part of this permit. All activities authorized herein must be carried out in accord with and for the purposes described in the application submitted. Continued validity, or renewal, of this permit is subject to complete and timely compliance with all applicable conditions, including the filing of all required information and reports, subject to and in accordance with the terms and conditions of the HCP.

B. The validity of this permit is also conditioned upon strict observance of all applicable foreign, state, local or other Federal law.

C. Valid for use by Permittee named above and "Participants" pursuant to the Agreement of Inclusion process described in the Permit Implementing Agreement by and between the Service and the Permittee (the "Implementing Agreement").

D. Acceptance of this permit serves as evidence that the Permittee (and their designated agents), understands and agrees to abide by the terms of this permit and all sections of title 50 Code of Federal Regulations, Part 13 and 17, pertinent to issued permits. Section 11 of the Endangered Species Act of 1973, as amended, provides for civil and criminal penalties for failure to comply with permit conditions.

E. The Permittee and Participants under the Implementing Agreement are authorized to "Take" (kill, harm, harass) the Madla Cave meshweaver (*Cicurina madla*), *Rhadine exilis* and *Rhadine infernalis* (no common names), to the extent described and specified in the EA/HCP, incidental to activities during the construction, operation, and management of new developments as described in the Permittee's application and supporting documents, and as conditioned herein.

F. The Permittee, Participants, and Management, as applicable, shall timely and completely comply with and perform their respective obligations under the HCP and the Implementing Agreement, such obligations being incorporated into the terms of this Permit by this reference.

G. Funding for the genetics study will be provided by the Permittee within 90 days of permit issuance.

H. Transfer of a preserve(s) to a third party, Service approved, Management entity shall in no way impair the ability to fully implement management and monitoring of the transferred or any other preserve(s) as described in the HCP. The Management obligations will be made binding through covenants that run with the Preserve or Preserves in question.

I. The Permittee or Management, as applicable, shall submit an Annual Report of preserves management and monitoring to the Service on October 1 of each year the permit is in effect. This report will include, but is not limited to, implementation of mitigation measures, inspection forms, results of regular inspections, management actions taken, any damage occurring and corrective actions taken, species and cave monitoring results (including copies of monitoring forms), and a report on the status of each listed species within the preserves.

J. Written annual reports of the years activities (including, but not limited to, the status of preserve acquisition and outreach and research projects), will be submitted by October 1 of each year to the U.S. Fish and Wildlife Service Office, 10711 Burnet, Suite 200, Austin, Texas 78758; and to the U.S. Fish and Wildlife Service Office, Room 4012, 500 Gold Ave. SW, Albuquerque, New Mexico 87102.

K. Upon written notification to the Permittee or Management, the Service will be allowed access to the karst preserves to inspect the condition of the caves and preserves to ensure that the HCP is being implemented according to its terms for the benefit of the listed species. In the event the Service finds that the HCP is not being implemented according to its terms, the Service has the option of terminating and revoking the permit in accordance with applicable regulations.

L. The "Covered Species" listed in Section 6.7.1 of the HCP are considered adequately addressed under the HCP and are, therefore, covered by no surprises rule assurances.

M. Upon locating a dead, injured, or sick listed karst invertebrate, or any other endangered or threatened species, Permittee is required to contact the Service's Law Enforcement Office, San Antonio, Texas, (210) 681-8419, for care and disposition instructions. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state for analysis of cause of death. In conjunction with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, the Permittee and its contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

N. Conditions of this permit shall be binding on and for the benefit of the Permittee and its respective successors and assigns. If the permit requires an amendment because of change of ownership, the Service will process that amendment without the requirement of the Permittee preparing any new documents or providing any mitigation over and above that required in the original permit. The construction activities proposed or in progress under an original permit may not be interrupted provided the required conditions of an issued permit are being followed.

O. If during the tenure of this permit the project design and/or the extent of the habitat impact described in the HCP is altered, such that there may be an increase in the

anticipated take of the karst invertebrates, the Permittee is required to contact the Service and obtain authorization and/or amendment of the permit before commencing any construction or other activities that might result in take beyond that described in the EA/HCP.

II. Status of the Species

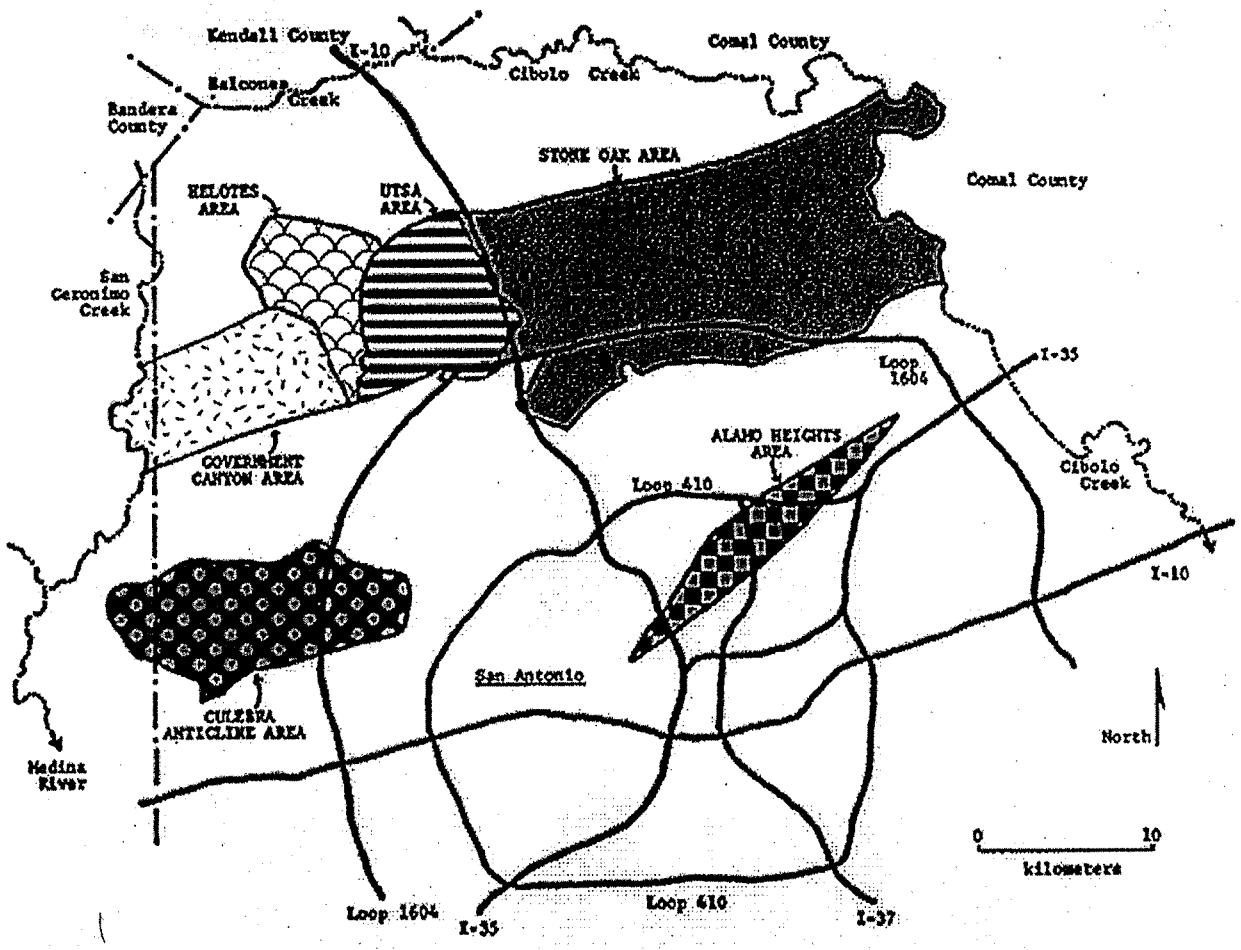
On December 26, 2000, the Service published a final rule and determined nine cave-dwelling invertebrates from Bexar County, Texas, to be endangered species under the authority of the Endangered Species Act of 1973, as amended. *Rhadine exilis* (no common name) and *Rhadine infernalis* (no common name) are small, essentially eyeless ground beetles. *Batrisodes venyivi* (Helotes mold beetle) is a small, eyeless beetle. *Texella cokendolpheri* (Robber Baron Cave harvestman) is a small, eyeless harvestman (daddy-longlegs). *Cicurina baronia* (Robber Baron Cave meshweaver), *Cicurina madla* (Madla Cave meshweaver), *Cicurina venii* (Braken Bat Cave meshweaver), *Cicurina vespera* (Government Canyon Bat Cave meshweaver), and *Neoleptoneta microps* (Government Canyon Bat Cave spider) are all small, eyeless or essentially eyeless spiders.

These nine invertebrates are obligate (capable of surviving in only one environment) karst or cave-dwelling species (troglobites) of local distribution in karst terrain in Bexar County, Texas. Habitat required by the nine karst invertebrate species consists of underground, void spaces that maintain high humidity and stable temperatures. The surface environment of karst areas is also an integral part of the habitat needed by the animals inhabiting the subsurface areas. While the life habits of the nine invertebrates are not well known, the species probably prey on the eggs, larvae, waste, carcasses and/or adults of other cave invertebrates and some are likely detritivores. In 1993, the Service contracted for two studies: one study (Veni and Associates 1994) discusses the overall karst geography in the San Antonio region and the potential geological and geographical barriers to karst invertebrate migration (on an evolutionary time scale) and limits to their distribution, and the other study (Reddell 1993) summarizes the distribution of the nine invertebrates known at that time.

Veni and Associates' (1994) report delineates six karst areas (karst regions) within Bexar County (Figure 3). The karst regions are as follows: Stone Oak, UTSA (University of Texas at San Antonio), Helotes, Government Canyon, Culebra Anticline, and Alamo Heights. The boundaries of these karst regions are geologic or geographic features that may represent obstructions to troglobite movement (on a geologic time scale), which have resulted in the present-day distribution of endemic karst invertebrates in Bexar County. The Property is located within the UTSA karst region, which is bounded by Helotes Creek to the west, Leon Creek to the east, and the limits of exposure of karstic terrain to the north and south (see Figure 1).

Veni and Associates (1994) and Reddell (1993) determined that only two of the now-listed species were present in the UTSA region, *R. exilis* and *R. infernalis*. Subsequent studies have also documented occurrence of Madla Cave meshweaver in the UTSA karst region outside the Property (J. Cokendolpher, Arachnologist, pers. comm. 2000). Biota surveys conducted by SWCA in 1994, 1995, and 2000 in the three La Cantera caves resulted in discovery of eyeless *Cicurina* spiders and *Rhadine exilis*, but no *Rhadine infernalis*.

Figure 3: Bexar County Karst Fauna Regions



III. Environmental Baseline

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area, not including the effects of the proposed action.

a. Status of the species within the action area (UTSA karst region)

Extensive ground surveys throughout the Property found that *Rhadine exilis* and a *Cicurina* sp. most likely *C. madla* are known from caves on the Property. Only three caves containing the listed karst invertebrates have been found. Two of these caves (La Cantera Caves #1 and #2) are known to contain *Rhadine exilis* and *Cicurina madla.* The entrances to both caves lie within 200 feet of the west-bound frontage road of Loop 1604, a heavily traveled road. Also, both caves are immediately south (approximately 100 ft.) of Retail Road, a two-lane road designed and constructed in 1999 to serve traffic to and from the commercial developments of La Cantera. The entrance to La Cantera Cave #3, which contains *Cicurina madla,* lies within 100 feet of La Cantera Parkway (Figure 2). Due to the proximity of all three caves to existing roadways, these features do not provide ideal conditions for long-term protection of the endangered invertebrates, and are considered by the Service to be medium quality.

Rhadine infernalis has been documented within the UTSA karst region (Veni and Associates, 1994) although it is not known from the Property.

Following is a table outlining the known locations of the Covered Species throughout the region. "Possibly" indicates a cave where a blind *Cicurina* species has been found, and based on the best available scientific information, this spider is most likely the federally listed endangered *C. madla*, but has yet to be confirmed.

Cave Name	*R. exilis*	*R. infernalis*	*C. madla*	Surrounding Conditions	Quality
Robbers Cave	Yes	Yes	Yes	centrally located within 147-acres of undeveloped land	High
Three Fingers Cave	Yes	Yes		centrally located within a large undeveloped tract	High
Hills & Dales Pit	Yes		Yes	within 74 acres to be preserved; approx. 130' from fenceline on one side; adjacent to the Robbers Cave tract	Medium*
Mastadon Pit	Yes			within approx. 300' of Loop 1604, contiguous with a large tract of undeveloped land	Medium
John Wagner Ranch Cave #3	Yes	Yes	Possibly	within 4 acre lot in developed, large-lot neighborhood, and contiguous with large tract of undeveloped land	Medium
La Cantera Cave #1	Yes		Possibly	adjacent to Loop 1604 but contiguous with large tract of undeveloped land	Medium
La Cantera Cave #2	Yes		Possibly	adjacent to Loop 1604 but contiguous with large tract of undeveloped land	Medium
La Cantera Cave #3			Possibly	adjacent to La Cantera Blvd. but contiguous with large tract of undeveloped land	Medium

* with potential to improve quality

A high quality cave has sufficient land area surrounding the cave to minimize negative edge effects and support cave cricket foraging and native flora and fauna communities, that are associated with a cave directly and typical for that area. If most of these criteria exist for a cave, but there is an ongoing impact that cannot be remedied, a cave may be considered a medium quality cave. For example, all of the medium quality caves listed in the table above are contiguous with a large enough area to support native flora and fauna; however, roads or other development are within a distance the Service believes could impact caves whether from contaminated runoff, removal of moisture through impervious cover, or increased edge effects.

Population estimates for any of the listed karst species are not currently available due to their rarity, inaccessibility, and secretive habits. Few individuals of each species are ever seen during a visit to a cave. Due to the limited knowledge and the subterranean nature of the karst invertebrates, estimations of population sizes are not feasible to obtain. Thus, an appraisal of impacts to cave features known to contain listed species tends to focus on impacts to the cave itself, its hydrologic drainage area (both surface and subsurface drainages), a minimum foraging area (typically believed to be 164 feet) for endemic cave crickets, and a minimum intact area of native vegetation to provide terrestrial ecosystem functions and buffers from edge effects of urbanization (which, subject to site specific considerations, the Service believes to be about 69 to 99 acres, based on a literature review and available information).

Over 400 potential karst features have been evaluated on the Property. Three primary geological assessments have been performed in the past and their combined scope has included the entire Property (Raba-Kistner 1993a and 1993b; SWCA 2000a; Horizon Environmental Services, Inc. 2000). The area surveyed by each company, as well as the scope of investigation, was different for each survey. Section I of the supporting documentation of the Habitat Conservation Plan (page 75 ff of the HCP) provides a summary of the karst invertebrate survey history and results, where appropriate, for each of the over 400 potential karst features identified on the Property. Where possible, correlations between the features have been made and are shown in Section I. The results of all of the surveys are given in Table I-15 in Section I of the HCP. All but three of the features (La Cantera caves #1, #2, and #3) identified during the course of the karst surveys were considered insignificant by the Permittee's consultants with regard to endangered karst invertebrate habitat.

b. Factors affecting species environment within the action area

No previous consultations have occurred within the UTSA karst region regarding these species. However, this is a rapidly developing area, and thus more are anticipated.

IV. Effects of the Action

The effects of the proposed project are quantitative (individuals of the species would be harmed within the proposed project) and qualitative (continued and increased degradation of cave ecosystem quality will occur from the proposed action).

a. Factors to be considered

The primary threat to the listed karst invertebrates is loss of habitat due to urban development activities. This loss may occur in association with a number of factors, including filling cave entrances or collapse of cave ceilings due to construction activities; alteration of natural drainage patterns (by activities such as altering topography, increasing impervious cover, installing berms or water collecting devices), resulting in drying or flooding; loss or degradation of the surface plant and animal communities, resulting in changes to moisture, temperature, or nutrient regimes of the karst ecosystem or increases in predation and/or competition; pollution; increasing invasion of fire ants; and, increased human visitation, vandalism, and dumping.

La Cantera Cave #3 will be closed (sealed) and totally impacted and La Cantera caves #1and #2 will remain open with development setbacks of one-acre each. Therefore, take of *Rhadine exilis* will occur in Caves #1 and #2, and take of *Cicurina madla* will occur in all three caves during the construction and occupation of the Property associated with the Preferred Alternative. In addition, take of any *R. infernalis* in these three caves would also occur. Although no endangered karst invertebrates are known to occur in areas proposed for development outside of the three La Cantera Caves, potential exists for listed species to be present in subsurface void spaces lacking obvious surface expression that could be destroyed or significantly disturbed by construction activities. Since all portions of the Property outside of the two proposed on-site karst preserves are expected to be developed, any endangered karst invertebrates occurring in these areas are expected to be taken by completion of the Preferred Alternative. Due to the extensive karst surveys of the Property, the likelihood of discovering previously undetected habitat is considered low.

Although no take of *Rhadine infernalis* is expected, *R. infernalis* is known from the UTSA karst region and has been adequately mitigated for within the proposed preserves; therefore, the Applicant will be covered for take of this species that may occur due to development on the Property. In the event the species is taken during construction and occupation of the Property, three karst fauna areas of equal or greater ecological value to the species within the UTSA karst region will still exist after the proposed development.

b. Analyses for effects and species' response to the proposed action

In evaluating the effects of the proposed action which are further described under Section 5.1 of the EA/HCP, we assessed the impacts in relation to the conservation strategy outlined for similar species in the Endangered Karst Invertebrates Recovery Plan for Travis and Williamson counties, Texas (1994). Recovery criteria in that plan call for the preservation, in perpetuity, of three karst fauna areas (areas separated from each other hydrologically and geologically), if three exist, for each species within each karst region. In reviewing the status of the affected species, we determined that three karst fauna areas within the UTSA karst region will exist after the proposed development. These areas are summarized in Section III. a. of this BO. In addition, all off-site preserve caves being provided as mitigation in the HCP are considered to be of equal or greater quality than the La Cantera caves being impacted by the proposed development.

The Applicant refers to the on-site setbacks as preserves in the HCP. We do not believe 1 acre is sufficient to provide a high probability for long-term viability for cave species, therefore, additional cave preserves are necessary to mitigate the impacts to La Cantera caves #1 and #2. In addition, we do not anticipate the species in La Cantera Cave #3 will survive in the long-term after the top 10-15 feet of the entrance is filled.

Not all of the off-site preserves are of ideal size for providing the highest probabilities for long-term survival of the karst invertebrates because the majority of surrounding land was not available to the Applicant at the time of HCP development. However, additional acreage does exist around the preserves and is currently contributing to conservation of these species; and thus, this land around those caves may become available for preservation in the future. The Applicant has agreed to contribute money toward development of outreach materials and to provide updated maps three times a year for three years from permit issuance as described in Section I of this Biological Opinion. This information will enhance the Service's ability to work with surrounding landowners and encourage more proactive protection and conservation efforts. The Applicant has also agreed to provide funds for developing definitive genetic techniques for identifying specimens of *Cicurina* (regardless of sex or age). The ability to quickly and definitively identify this species will greatly enhance conservation efforts for this species.

Caves included in the mitigation proposal were chosen in part based on type and diversity of troglobitic species contained therein and availability of land in surrounding areas. A relatively high diversity of troglobitic species and the presence of undeveloped land for relatively low-density residential areas near these properties made acquisition of these preserve areas highly desirable. Appendix I of the HCP provides a detailed description of each preserve (and caves within) that will be established.

c. Beneficial effects

The acquisition and permanent preservation of 8 caves within a total of 179 acres (John Wagner Cave #3, Hills and Dales Pit, Helotes Hilltop, Helotes Blowhole Cave, Scenic Overlook Cave, Canyon Ranch Pit, Fat Man's Nightmare Cave, and Madla's Cave), not only provides some protection of *R. exilis* and *C. madla,* but also provides conservation opportunities for other listed invertebrates, including *Rhadine infernalis* and *Batrisodes venyivi,* as well as at least two new undescribed troglobitic spider species, a *Neoleptoneta* n.s. and a *Texella* n.s. The proposed mitigation caves also include the type localities of four of the nine Bexar County listed invertebrates (Table 1). Additionally, the educational outreach materials and research efforts will continue to contribute to our knowledge and understanding, as well as the public's, of these species.

V. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future

Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Bexar County has undergone rapid and sustained development and continues to be a fast-growing urban area, including the land in the vicinity of the project (a discussion of this growth is in Section 3.11 of the EA/HCP). It can be assumed that, with or without the proposed action, urban development will continue to encroach upon the important areas for listed species in the action area. Much of the land adjacent to the Property is currently being developed, both for commercial and residential use. As the natural environment is developed and converted to urban land, the ecosystem dynamics that influence the endangered karst invertebrates will likely be altered to the detriment of these species.

VI. Conclusion

After reviewing the current status of *Rhadine exilis, Rhadine infernalis*, *Cicurina madla*, the environmental baseline for the action area, the effects of the proposed project, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of *Rhadine exilis, Rhadine infernalis*, or *Cicurina madla*. No critical habitat has been designated for these species, therefore, none will be affected.

B. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Section 3 of the Act defines take as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct." Harm and harass were both further defined in 50 CFR 17.3. Harm is defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The HCP and its associated documents clearly identify anticipated impacts to affected species likely to result from the proposed taking and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the HCP, together with the terms and conditions described in the Implementing Agreement and any section 10(a)(1)(B) permit or permits issued with respect to the HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement

pursuant to 50 CFR 402.14 (i). Such terms and conditions are nondiscretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the act to apply. If the Applicant fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse. The amount or extent of incidental take anticipated under the La Cantera HCP, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the HCP and its accompanying section 10(a)(1)(B) permit.

Amount or Extent of Take Anticipated

La Cantera Cave #3 will be totally impacted and sealed. We do not expect the species to persist in this cave. La Cantera caves #1and #2 will be negatively affected through major impacts we believe will reduce the long-term viability of the cave species in those caves. Therefore, take of *Rhadine exilis* will occur in caves #1 and #2, and take of *Cicurina madla* will occur in all three caves during the construction and occupation of the Property associated with the proposed action. Although no endangered karst invertebrates are known to occur in areas proposed for development outside of the three La Cantera Caves, the potential exists for listed species to be present in subsurface void spaces lacking obvious surface expression that could be destroyed or significantly disturbed by construction activities. Since all portions of the Property outside of the two proposed on-site karst preserves are expected to be developed, any endangered karst invertebrates occurring in these areas are expected to be taken by completion of the action in the Preferred Alternative. Due to the extensive karst surveys of the Property, the likelihood of discovering previously undetected caves is considered low.

Although *R. infernalis* is not known from the Property, but is known from the UTSA karst region, there is a possibility that it could be present and taken during construction. Therefore, the Service reviewed the adequacy of mitigation for this species should it be present and taken on the Property. We found that it has been adequately mitigated for within the proposed preserves, and therefore, the Applicant will be covered for take of this species on the Property. No take of any other endangered karst invertebrate species is expected to result from completion of the Preferred Alternative.

The Preferred Alternative would provide for the protection of one acre each, around caves #1 and #2, while Cave #3 would be partially filled and covered with a detention pond. Other karst features not included in the proposed karst preserves, and not including listed species, or their habitat, lie in areas that would be developed subject to TNRCC regulations (Edwards Aquifer Rules) for protection of water quality within the Edwards Aquifer Recharge Zone.

Effect of Take

Two listed species, *Rhadine exilis* and *Cicurina madla*, are known to occur on the Property. Both of the species are present in La Cantera Cave #1 and La Cantera Cave #2; *Cicurina madla* is also present in La Cantera Cave #3. None of the other seven listed species of Bexar County

karst invertebrates is known from the Property, nor is there expected to be any impacts to these species.

As part of the proposed action, an HCP has been proposed to avoid, minimize, and mitigate for the potential adverse impact to the species and their habitats described above and assure that this action does not reduce the potential for survival and recovery of the listed karst invertebrates as mandated by requirements of 50 CFR Part 17.22(b)(1)(iii). The HCP is detailed in Section 6.0 of the EA/HCP.

Reasonable and Prudent Measures

The reasonable and prudent measure necessary and appropriate to minimize incidental take of the affected species on the Property is:

> The Service will make all permit conditions described in the proposed action binding on the Applicant, Participants, or Management as outlined in the Implementing Agreement and the EA/HCP.

Terms and Conditions

In order to be exempt from prohibitions of section 9 of the Act, the following non-discretionary terms and conditions, which implement reasonable and prudent measures described above, must be complied with:

> Any section 10(a)(1)(B) permit, as evaluated in this Biological Opinion, that is issued by the Service must contain the permit conditions described in the Proposed Action section of this BO.

C. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

A. The Service should use the outreach materials created for the karst invertebrates to work with landowners adjacent to the preserves to enhance protection and to further conservation throughout the species range.

B. The Service should assist in specimen collection and fund a genetics study of *Texella* species in Bexar County to be done in conjunction with the study for *Cicurina* species.

D. REINITIATION NOTICE

This concludes our formal consultation on the issuance of a permit pursuant to section 10(a)(1)(B) of the Act to allow the incidental take of the affected species during and following construction on 1,000 acres of the Property in San Antonio, Bexar County, Texas. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the action is subsequently modified in a manner that causes an effect to a listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Concur:

Nancy M. Kaufman
Regional Director

10/22/01
Date

E. LITERATURE CITED

Horizon Environmental Services, Inc. 2000. Karst investigation 136-acre La Cantera retail property at Loop 1604 and La Cantera Boulevard San Antonio, Bexar County Texas. Unpublished report prepared for The Rouse Company, Columbia, Maryland.

Raba-Kistner Consultants, Inc. 1993a. Geologic assessment for water pollution abatement plan, La Cantera Village, San Antonio, Texas. Unpublished report for Pape-Dawson Engineers.

Raba-Kistner Consultants, Inc. 1993b. Geologic assessment for water pollution abatement plan, La Cantera Retail Center, San Antonio, Texas. Unpublished report for Pape-Dawson Engineers.

Reddell, J.R. 1993. The status and range of endemic arthropods from caves in Bexar County, Texas. A report to the U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department.

SWCA, Inc. 2000a. Results of karst terrain features investigations of the La Cantera property northern Bexar County, Texas. An unpublished report prepared for the La Cantera Development Company.

U.S. Fish and Wildlife Service. 1994. Endangered Karst Invertebrates Recovery Plan. Albuquerque, New Mexico. 154pp.

Veni and Associates. 1994. Geologic controls on cave development and the distribution of endemic cave fauna in the San Antonio, Texas, Region. Prepared for Texas Parks and Wildlife Department and the US Fish and Wildlife Service.